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and Maintenance of Way

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Painting Steel Bridges in Winter

EXPERIENCE has taught bridge engineers that the time to paint a new steel bridge is shortly before it starts to corrode or preferably immediately after the structure is erected. This no doubt is followed out as far as practical in the summer months, but should it so happen that a bridge is completed during the cold winter months, which is so often the case, it is a question whether the painters would attempt to touch it before the warm days of spring.

With possibly some exceptions, it may be said that there exists among railroad bridge painters an idea that it is poor practice to paint steel bridges during cold weather. This opinion may result from various causes, principally the fear that paint applied to metal in cold weather is not durable and that the cost of labor and material is increased.

Results obtained from experiments along this line would indicate that such an opinion is not tenable. It has been found that metal can be painted successfully without danger of decreasing its efficiency if the paint is applied when the atmosphere is moderately free from humidity and the metal is free from frost. In one experiment a bridge was painted immediately after completion, with a double coat, on a clear day when the thermometer stood as low as 4 degrees above zero. Upon comparing this work six years later with some work done the following summer, no difference could be detected in its durability. In fact the work done during the winter stood the test better as it did not show the additional four month's exposure to which it had been subjected. The locality in which this experiment was made had several advantages which will not be found in all places:—namely, the surrounding land was free from alkali while the atmosphere was not permeated with sea fogs or gases. From the result of this experiment it appears that under certain conditions it is practical to paint metal during cold weather when the occasion arises.

Relative to the increased cost of labor and materials, it is stated that at no time during this test in the winter did the work exceed the estimated cost, although the expense was slightly increased for both labor and material. This might be expected as much time is spent by the men in keeping warm, and there is naturally inconvenience in handling icy material.

It would seem then, that when a steel bridge is completed during the winter, painters should have no hesitancy in beginning their work at once if conditions are favorable.

Cattle Guards

THE subject of cattle guards would seem to have been looked upon rather indifferently. Railroad officials apparently have formulated their practice some time since and do not appear disposed to reconsider them, although conditions have changed materially during the last five years.

Generally speaking, a cattle guard is an unproductive

investment, in that it makes no direct return for the original cost. However, the same is true of fencing and the cattle guard is an integral part of the fence. Railroads will fence against stock within two feet of the rail and then fill in the track space with a structure that is seemingly used with the object principally of avoiding legal liability. A prominent engineer recently expressed the opinion that the object of a cattle guard is to comply with the law and incidentally to stop some stock.

Such an attitude would lead to the conclusion that the railroads are inclined to use an inexpensive device as a cattle guard and this condition developed from the extravagant prices asked for stock turners on the market a few years ago. At that time railroads were offered guards priced at $15 to $18 and were assured that the devices offered were absolute stock turners. The most efficient of these were found to "cast" animals that attempted to enter the right of way by crossing the cattle guard. This would leave them lying on the track as a danger to approaching trains. A further danger which developed was that the sheet metal of which some guards were made would occasionally became loose and engage a locomotive pilot, a break beam, or some other part of a passing train. Pockets formed by the parts of the cattle guards collected dust, leaves and moisture, which caused the metal to deteriorate rapidly, resulting in a life of short duration, considering the high initial cost. The several undesirable features of the steel cattle guard have led to the wide adoption of the wooden guard. Types of wooden guards, designed several years ago, are still in service and the extent to which they are used would lead to the conclusion that of the guards available they are the most satisfactory. The most popular of these consists of wooden bars arranged parallel with the track and framed in sections. Preferably such sections are interchangeable. The bars are so arranged that no pockets are formed which will collect debris and moisture and the upper edges of the bars are made sharp so as to present an uneven footing and thus deter any cattle that might attempt to cross them.

In view of the service which would be rendered by a really effective cattle guard and in view of its relation to damage suits, it would seem that a concerted effort on the part of maintenance of way officials to provide a cattle guard which would actually perform its functions would be a move in the right direction.

The Designation of Subjects in Railway Club Proceedings

THE value of the papers and discussions contained in the proceedings of the several railway clubs is so thoroughly appreciated that these proceedings are read regularly and looked for eagerly by most railway officials, as well as by others in different lines of business more or less closely associated with railroad work.

In view of the large amount of interesting material published each month it is necessary for the busy man to determine with as little effort as possible the nature of the subject under discussion in each pamphlet, paper or publication that reaches him. To this end it would seem of great advantage if each railway club would see that the subject contained in the monthly issue of its proceedings is clearly designated in large letters on the front cover of the pamphlet.

On some of them the contents is indicated very clearly, notably in the proceedings of the Western Railway Club and of the Canadian Railway Club. On others, the title is presented in such small type and is so nearly lost among the other type appearing on the front cover that it requires a search to determine the nature of the paper. On still others the title of the paper included is omitted entirely. Again there seems to be no definite place where the title is to be found. It may be found at the top, bottom or center of the page.

To improve this feature of the railway clubs it would seem practical if the association of Railway Club Secretaries would determine on a specified location of given size on the front cover to contain the subject for discussion, the author of the paper and the name and address of the secretary.

Each club proceeding has a distinctive individuality due to the color of the cover used, the kind of type and the method of writing the name. This feature is commendable and each club proceeding should maintain its distinctive individuality. At the same time, however, it would be of advantage not only to the respective members but to all railroad men, if the clubs would determine some specified location and method of designing the subject contained in the individual issue of the proceedings.

Spring Track Work

AS THE frost leaves the ground there will be a large amount of work required of the maintenance of ways forces. The trackmen in particular will find their hands full after a severe winter, especially in sections of the country where there was a great deal of heaving and consequently much shimming. Since the frost goes out gradually, it will be found necessary in many places to substitute thin shims for heavier ones and later, when the roadbed has settled to its normal condition, it requires additional work to remove the remainder of the shims.

The drainage at this time of year is an important factor, and labor judiciously spent in this direction has prevented many washouts and landslides. All ditches should be cleaned out and all obstructions removed from culverts and trestles, so that the accumulating water may pass off as fast as it gathers.

It is natural that the roadbed should be in a soft condition at this time of year, and therefore, the principal aim should be to have it dry out; this will be effected quickest by getting all drains and ditches to work as soon as possible. Should, however, bad spots develop in the track which might cause an accident, the track foreman should put out slow flags and notify the roadmaster and train dispatcher, so that trains may be cautioned; the next step should be provision made for bringing the roadbed and track up to regular standard at the earliest possible moment, and the foreman will have a splendid oppor-

tunity to show what executive ability he possesses. Many times a car load or two of cinders have permanently cured a bad, saggy spot in a track; other times the insertion of drain tile has had splendid results, while frequently the digging away of bad material and the substitution of porous material has proven effective. The foreman in charge should be the best judge of what is necessary to be done, and the most competent man will regularly have the least trouble; he takes time by the forelock and anticipates many of such difficulties before they happen,—thus he looks forward to these early spring troubles by cleaning out his ditches thoroughly late in the fall; now as the snow begins to thaw in the spring the ditch will be in fair shape to carry off the water preventing its soaking into the roadbed. He always has a few extra ties available, so if he finds that he has several broken ones alongside of each other, he places them in the track to make it safe; he also keeps on hand a reasonable supply of such tools and materials as the season may call for; he always has track spikes, bolts and nutlocks on hand to take care of his daily requirements, and the rail joints on his section have always their full quota of bolts and nutlocks. He always has fence wire and staples on hand to repair the right of way fence and he uses it promptly. Thus his section seems to be singularly free from accidents or stock killed. The other foremen think and say he is lucky; but it is readily seen that luck does not mean anything; for had his neighbor, the improvident foreman, understood and fully lived up to his duties, he would have had fence wire and staples on hand to repair the break in the fence. Instead of that he had to order these supplies and in the meantime, some stock entered the right of way through that break in the fence and got killed. That means the railway company will have to pay a snug sum of money for damages, which might have been prevented had the foreman fully done his duties.

New Roundhouse at Oneonta, N. Y.

Delaware & Hudson Co.

First Installment

IN 1902 the American Railway Master Mechanics' Association adopted the recommendation of a committee report on the "Arrangement and Accessories of an Up-to-Date Roundhouse." Among the many proofs that the report has influenced later roundhouse construction may be mentioned the roundhouse completed recently by the Delaware & Hudson Company at Oneonta, N. Y. While it is not an innovation in roundhouse construction, it is a good example of a modern locomotive terminal built in accordance with established practice.

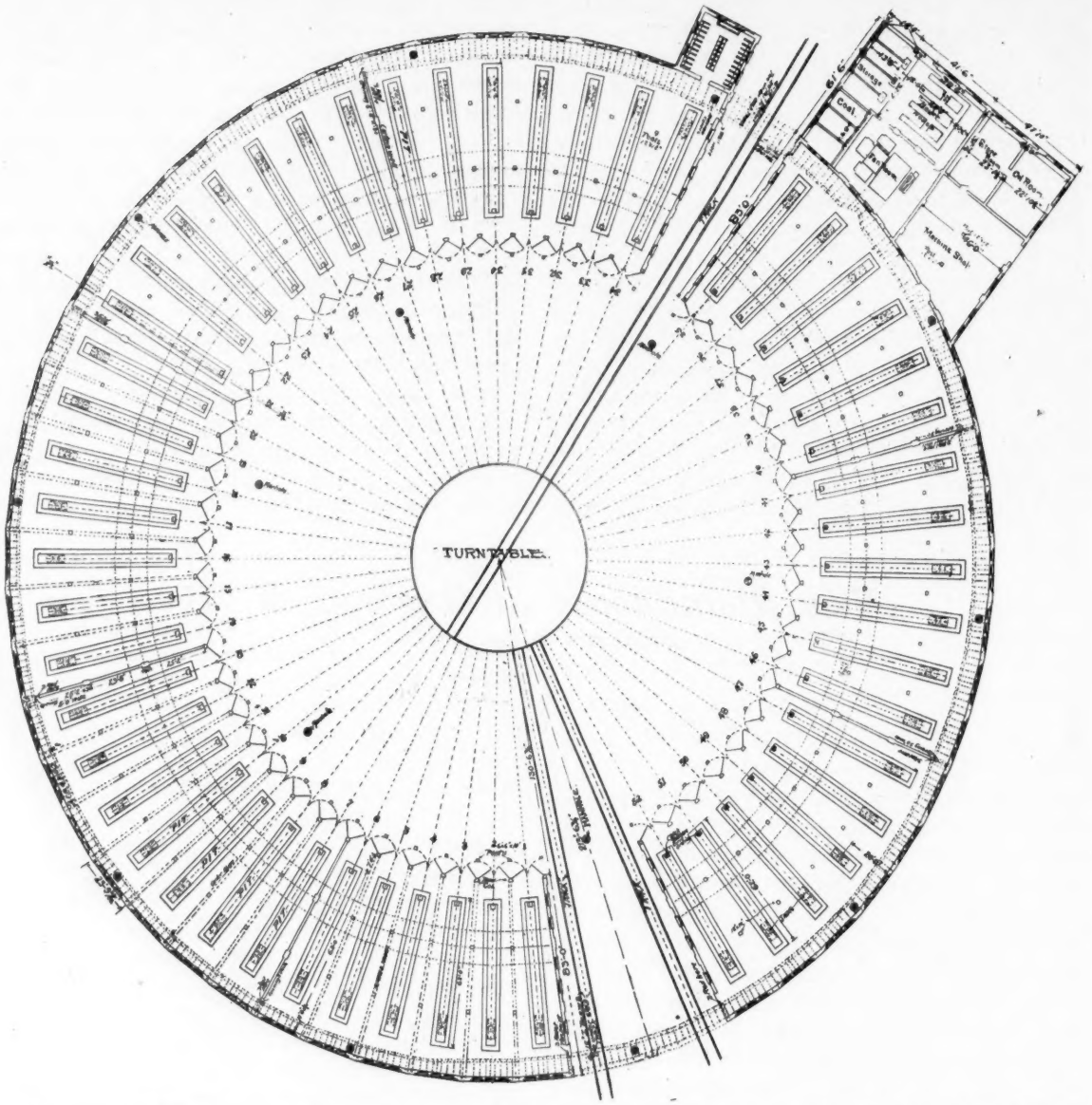
The features that especially commend themselves are found in the ample storage tracks, the facilities provided for hostling engines and the convenient arrangement of equipment and accessories. The unusual depth of concrete foundations made necessary from the fact that the roundhouse was built in a swamp, and the substantial construction of the buildings is worthy of note.

The layout has been planned in accordance with modern practice to obtain rapid movement of locomotives to and from the roundhouse. The location of coal shed, cinder pit, water cranes, service and storage tracks are in line with the latest developments in the outside facilities of a locomotive terminal.

The roundhouse has a span of 83 feet over walls and embraces a complete circle. It is divided into three sections, containing a total of 52 repair pits of which four are arranged for dropping driving wheels. An annex 61 feet 6 inches by 108 feet 6 inches, contains the machine shop, store house, boiler room, oil house and fan room. The machine shop and store house are of convenient access to the roundhouse and the fan room is located so that the fans deliver direct to the heating conduit. In the section adjacent to the machine shop, the toilet room, a building 27 feet by 28 feet 8 inches, is placed, and entered directly from the roundhouse.

The turntable is 75 feet long and operated by an electric motor. Three tracks enter the roundhouse cir-

GENERAL VIEW OF ROUNDHOUSE, ONEONTA, N. Y.—D. & H. CO.



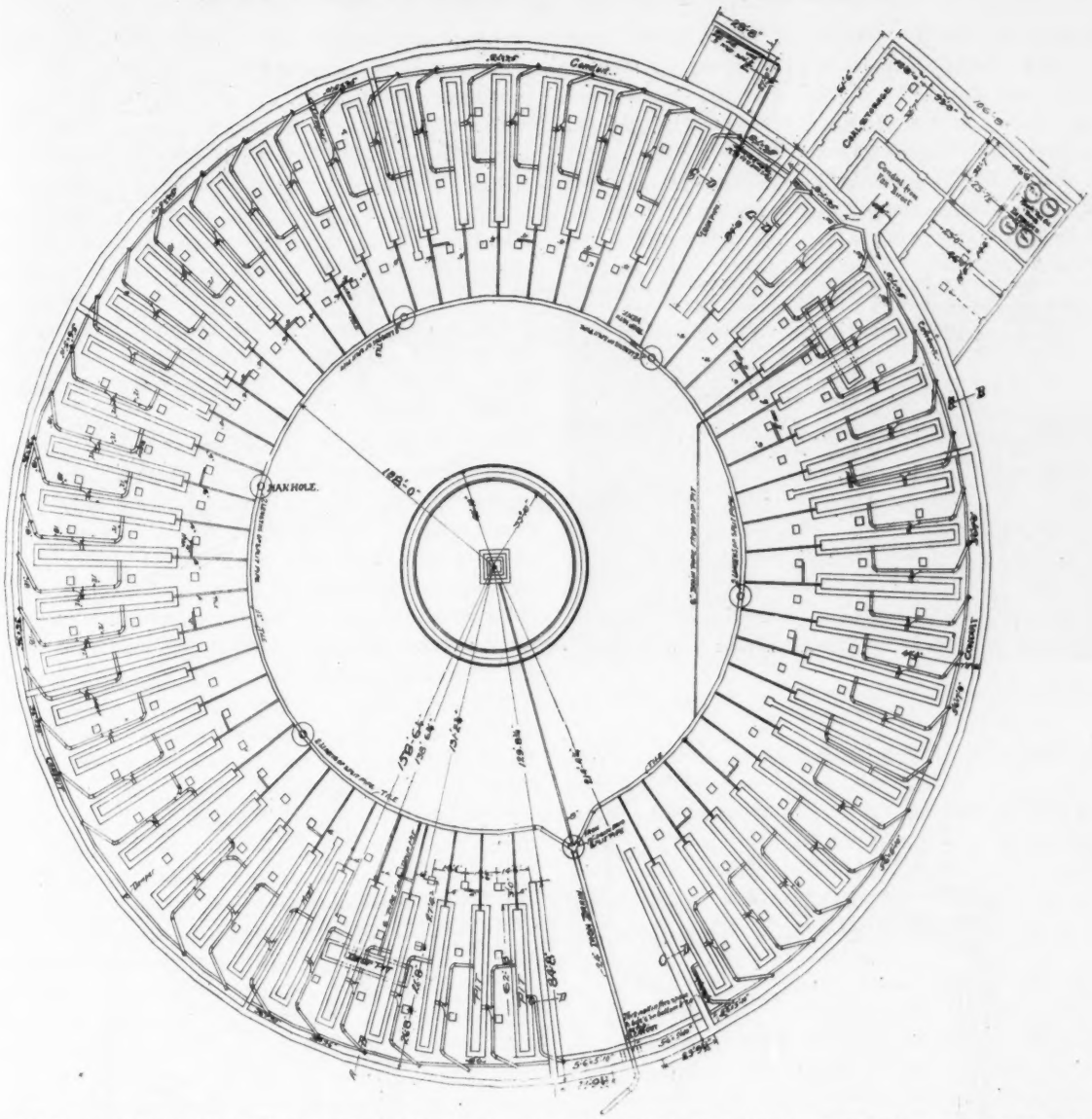
GENERAL PLAN, ONEONTA ROUNDHOUSE, SHOWING ARRANGEMENT OF PITS AND SERVICE TRACKS AND LOCATION OF MACHINE SHOP AND STORE HOUSE—D. & H. CO.

cle, two of which are used for in-coming engines, while the third track is for out-going engines alone. The cinder pit is 105 feet long and accommodates both in-coming tracks. Two water cranes are placed close to the cinder pit and serve the four in and out-going tracks.

In construction, concrete was used for foundations, pits, conduits, floors and facing for turntable pit. Brick was employed in the walls of all buildings and for a backing of the concrete facing in drop pits. The roof is of wooden construction covered with 4-ply slag roofing and a mopping of pitch between the third and fourth layers in addition to the poured coat on top, using wood diamond cleats for flashings. Wired glass is used for all skylights. Wooden beams, supports and braces have been used in all the buildings to the almost entire exclusion of steel.

The cross section of the roundhouse is of the most economical type to build. The roof, while nearly flat, slopes slightly both ways from the lantern and is supported by posts and has a maximum height of 21 feet 2 inches and a minimum height of 19 feet 4 inches above the floor. The cross section seems to be chosen for economy rather than efficiency as the head room is limited, and experience would indicate that supporting posts are not desirable features of a roundhouse. The lantern, 13 feet wide and 7 feet 6 inches to the eaves, is placed 26 feet 8 inches from the inner wall in a position that gives good illumination for the cabs of locomotives. The smoke jacks are of the adjustable type with an 8 feet flare on lower end, and set 20 feet from the outer wall.

The door posts are cast-iron box section and spaced

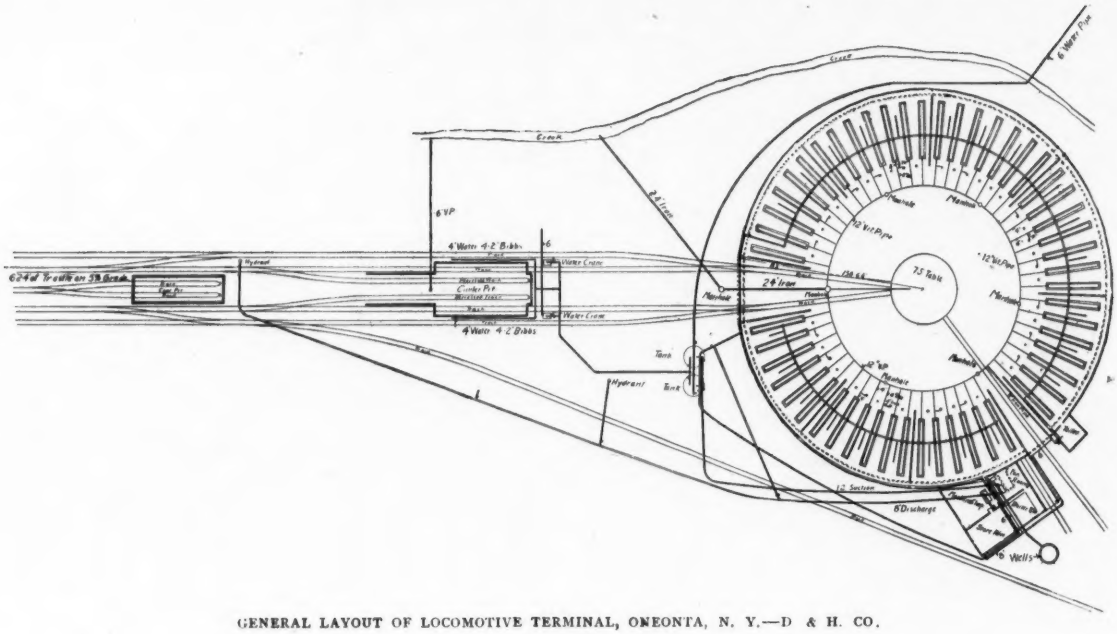


GENERAL PLAN, ONEONTA ROUNDHOUSE, SHOWING LOCATION OF DRAIN AND WATER PIPES AND ARRANGEMENT OF HEATING PIPES AND CONDUIT—D. & H. CO.

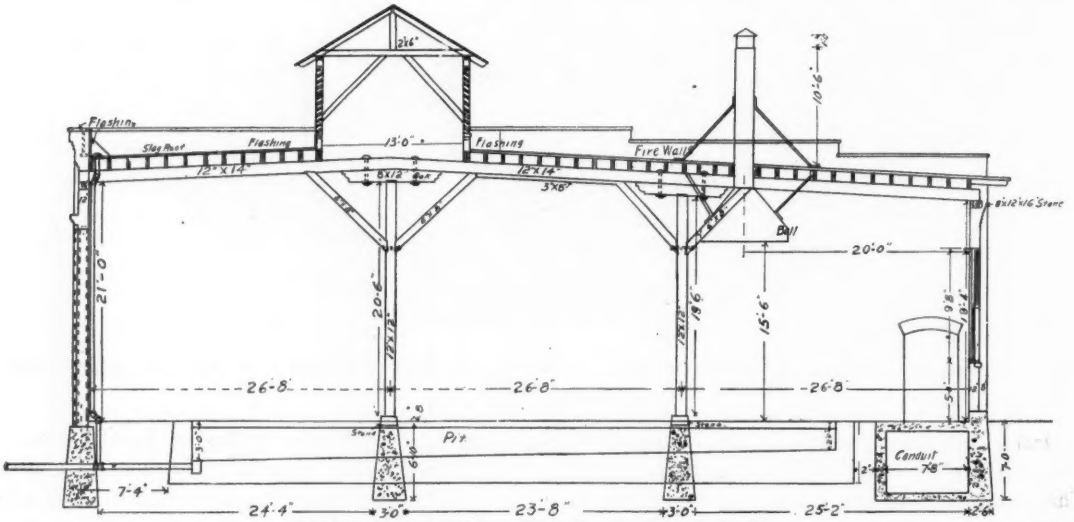
14 feet 6 inches from center to center, leaving a free door opening of 13 feet 1 inch wide and 17 feet high. The doors are made of 1½x3 inch matched pine and are hung on three strong pin hinges securely fastened to the door posts.

There are 48 repair pits, 58 feet 8 inches long and 4 feet wide, built entirely of concrete, with walls 20 inches thick on the sides and from 24 to 36 inches on the bottom. The floors of the pits are convex, the center being 3 inches higher than the sides and longitudinally there is a drop of 12 inches toward the inner end, for drainage. The rails are supported on a series of stone blocks 12 by 12 by 8 inches, set 3 feet apart and projecting 1 inch above the coping of the side walls.

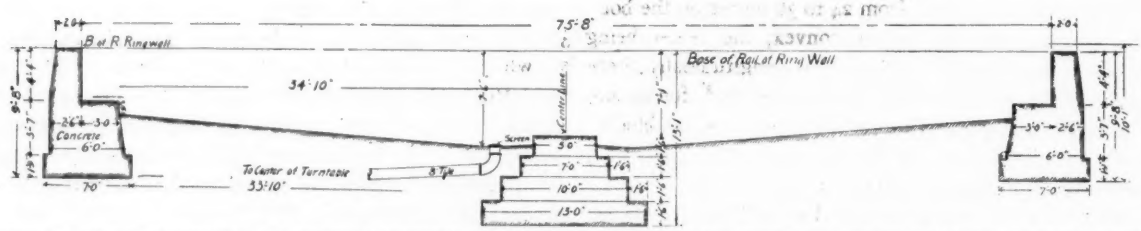
There are four tracks arranged with drop pits for removing driving wheels, while no provision has been made for handling truck wheels. One pit is arranged for two tracks and will accommodate drivers under 78 inches in diameter. The drop pits are 6 feet deep and 6 feet 6 inches wide, with walls of concrete, 12 inches thick backed with walls of brick 8 inches thick. Between the two walls are placed five layers of Hydrex waterproof felt, cemented together. Below the transfer track is a drainage pit 2 feet wide and 2 feet 8 inches deep which inclines from both ends to a point at which the drainage pipe is located. The removable rails are 8 feet 8 inches long mounted on 12 by 12 inch beams which are supported on ½ inch iron plates set in the side walls. Wrought iron handles are placed on the beams for convenience in handling.



GENERAL LAYOUT OF LOCOMOTIVE TERMINAL, ONEONTA, N. Y.—D & H. CO.



SECTION OF ROUNDHOUSE, ONEONTA, N. Y.—D. & H. CO.



SECTION THROUGH TURNTABLE PIT, SHOWING CONCRETE WALL FACING, FOUNDATION FOR TURNTABLE AND PIT DRAINAGE—ONEONTA ROUNDHOUSE, D. & H. CO.

Railroad Building in the Southeast

RAILROAD building in the southeast has been very active during the past year and is at present enjoying a period of great activity. The natural resources of the South have lain comparatively undisturbed for a great many years, but with the present fever of construction, it seems that conditions will soon be changed considerably. For some time several systems have had a practical monopoly of traffic and new construction in the South. However, with a changed system of politics, and an Interstate Commerce Commission that is invested with considerable power, smaller companies are acquiring rights of way and are actively engaged in railroad construction. To look at a map of the southeastern states one might think that there is scarcely any need of further work of this nature. A close study reveals, on the contrary, a lack of direct connection between many of the larger cities. The one great trouble with the present lines in operation is the large amount of heavy grades and curvature. While there is no doubt that southern railroads are making money, it cannot be gainsaid that operating under such conditions is very expensive work.

The proverbial excuse for a good many suits and acts which are brought against the railroad company is the claim that the company is very prosperous and ought to feel willing to share its earnings among many. This is true probably to some extent but on the other hand the complaining parties never look back to the time when the road was being built, the struggle it had during construction, and more than that, the problem of meeting its financial obligations the first year or two. Railroad companies receive very little sympathy because these conditions are never considered or remembered.

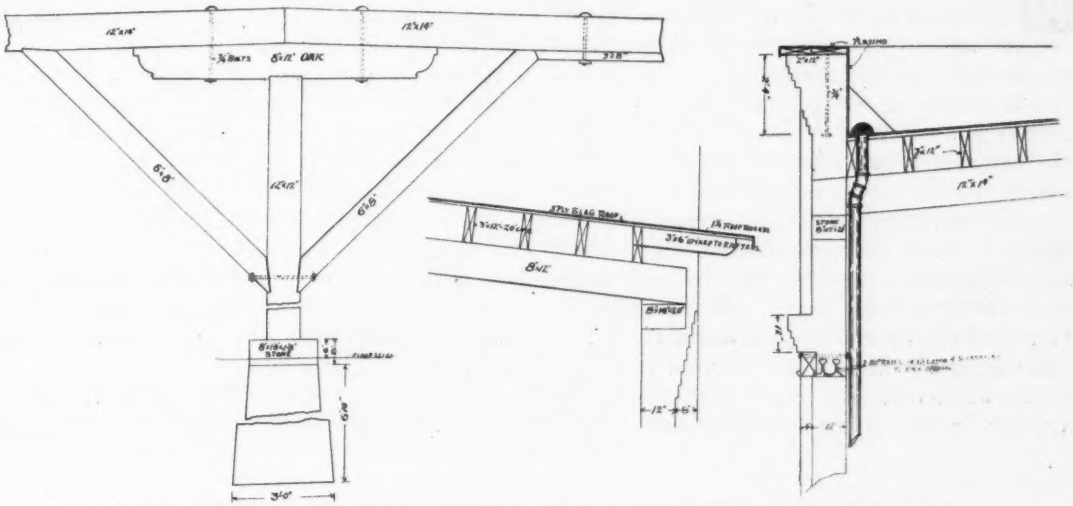
One of the examples of road building, with what might be termed "local capital," is a new road that is to be built from Savannah, Ga., north to the Tennessee-Georgia line. This road has been chartered as the Savannah, Augusta and Northern Railroad Company for 101 years and under a capitalization of $8,000,000. When completed the road will have the longest direct line in the state, having a total of 402 miles. It will run from Savannah in a northerly direction on the eastern border of the state and will touch a portion of Georgia that hitherto has been undeveloped. While the intention of this company is not fully known it is believed that the road will eventually be extended to Chattanooga, Tenn., which will provide a good northern and western outlet. With a line into Chattanooga, the road would connect with all the western lines and could bring all the western shipments

CINDER PIT, STORAGE AND SERVICE TRACKS—ONEONTA ROUNDHOUSE, D. & H. CO.

into the eastern and southern states, that at present have no direct line.

The noteworthy feature of this company is its lack of outside capital. With only one exception the incorporators are all residents of Bullock County, Georgia. Building under such conditions railroads should and no doubt will receive good treatment at the hands of the people living in the vicinity of the road.

The Seaboard Air line is launching out into active railroad construction. It is credited with the purchase of the Macon, Dublin and Savannah Ry. This road which operates between Macon and Vidalia, Ga., is comparatively new, having been completed from Macon to Dublin in 1891 and from Dublin to Vidalia just a few



DETAILS OF ROOF SUPPORTS, ONEONTA ROUNDHOUSE, D. & H. CO. THE SYSTEM OF ROOF DRAINAGE IS SHOWN.

years ago. The original purpose of the road was to secure means of developing natural resources, as the country through which it was projected, contained valuable pine timber. It passed through the financial panics of the early nineties without a single embarrassment. The later extension from Dublin to Savannah gave Macon its first direct outlet to the sea. It was purchased by the Seaboard from the Atlantic Coast Line who held the road for a short time. With an extension from Macon to Atlanta the Seaboard gives a direct and short line from Atlanta to its seaport at Savannah. Again with the new South and Western Railroad connecting the Southwestern Virginia coal fields to the Seaboard connection at Bostic, N. C., and its new Atlanta and Birmingham line, the Seaboard will gain a large amount of coal and iron traffic. This has hitherto been deflected and carried to some of the communities in these districts by roundabout connections and hence entailing a large amount of time and expense to the interested public.

It is thought that the Atlantic Coast Line will construct a new line from Liberty City, Ga., to Vidalia and by using the Seaboard tracks secure a line from their Savannah terminus to Atlanta.

In Mississippi railroad building is also experiencing considerable activity. The securing of an entrance to the harbors of Gulfport and Pascagoula seems to be the cause of a good deal of this enthusiasm. The Mississippi Central has already commenced work on its Hattiesburg-Pascagoula line, 10 miles of this having been under construction during the past year. This company's main efforts are centered on the Natchez-Brookhaven end of the line and they will attack the southeastern extension more vigorously when the Mississippi River connection is finished. Not only is the Mississippi Central endeavoring to develop the Pascagoula harbor but the Baton Rouge, Hammond and Eastern, the Birmingham and Mississippi Southern, the Mobile, Jackson and Kansas City and even the Frisco-Rock Island system are credited with like purposes.

The Birmingham & Mississippi Southern is a projected line which, though it has no substance yet except on paper, is regarded as one of the certainties of the near future. It is destined to run from Birmingham to Baton Rouge, and thence into New Orleans, with several branches. In projecting this line the main purpose is to develop some of the large untouched timber lands in southern Mississippi and carry the timber to northern, and also gulf port, outlets.

In just such a manner the projecting and construction is going on all over the South and with the almost unlimited natural resources at hand the ultimate successes of the new roads are unquestioned.

American Railway Engineering and Maintenance of Way Association

Eighth Annual Convention

THE Eighth Annual Convention of the American Railway Engineering and Maintenance of Way Association which will be held at the Auditorium Hotel, Chicago, March 19 to 23, is one of the most important railway conventions of the year to the engineering departments of the railroads. There are a number of conventions representing the various departments but for breadth, scope and importance of the subjects discussed this is the convention around which the most interest centers. This association has been growing stronger and larger every year, the one just past witnessing the largest increase in membership, sixty new members having been added. While there were 210 members in attendance last year, there were a large number of railway men present who were not members. From the interest shown in the coming meeting the attendance this year will be much larger. Secretary Fritch is greatly pleased with the outlook for this year and expects one of the most interesting and important meetings ever held. This convention works hard during the whole time it is in session. There are no interruptions or trips of any kind from start to finish and the only diversion the association allows itself is the annual dinner. On this occasion the association is addressed by several speakers of national reputation. This year the committee has been very fortunate in securing several speakers of prominence, whose addresses will be most interesting at this time in view of the railroad questions at issue and the prominence of the speakers.

The enormous amount of work done by this convention is appreciated by those in whose interest the thankless task of committee work is undertaken. There are seventeen different committees, consisting of a dozen or more members each. Already Secretary Fritch has received the reports of every committee except two and these have reported progress so that it is expected every committee will be heard from at the convention.

The convention will begin Tuesday, March 19th, in the Banquet Hall of the Auditorium and continue each day, morning, afternoon and evening, following, except Wednesday, until finished. On Wednesday evening the annual banquet will be held. The committee in charge of arrangements is as follows:

T. L. Condron, Chicago; E. R. Coates, Chicago; G. E. Ellis, C., R. I. & P. R. R., Chicago; M. E. Shire, Chica-

go; W. A. Wallace, Engineer C., I. & L. R. R., Chicago.

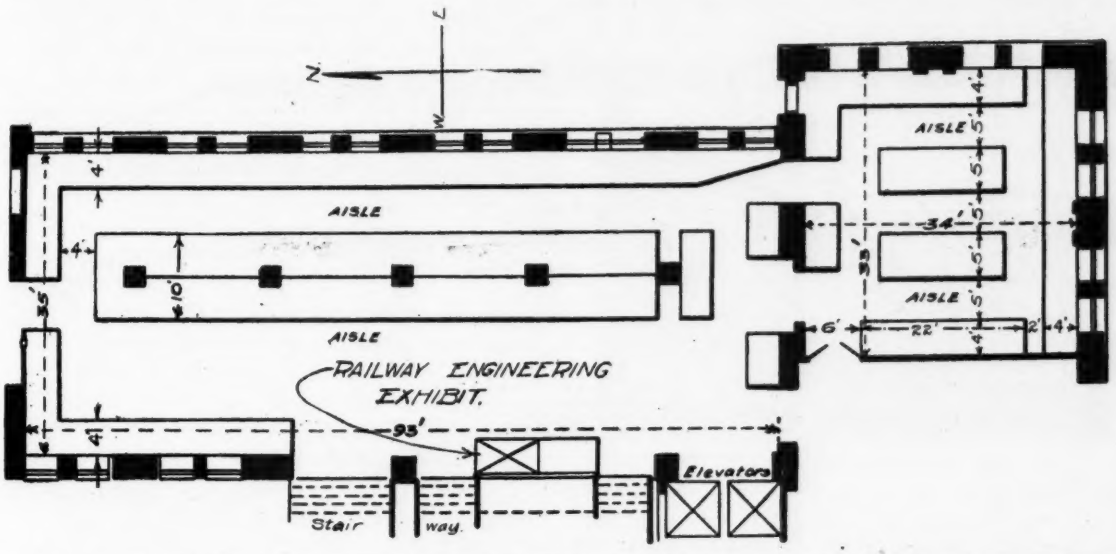
The organization of the association consists of the following committees numbered consecutively in the order given:—Roadway, Ballasting, Ties, Rail, Track, Buildings, Wooden Bridges and Trestles, Masonry, Signs, Fences, Crossings and Cattle Guards, Signalling and Interlocking, Record Reports and Accounts, Uniform Rules and Organization, Water Service, Yards and Terminals, Iron and Steel Structures, Economics of Railway Location and Classification of Tracks.

This year the most important and interesting paper to be presented will be the report on "The Economics of Railway Location." This subject represents a great deal of original work and it will be heard with more than usual interest.

Another feature of this year's meeting is the fact that second floor of the Auditorium Hotel, allotted to each exhibitor has been reduced to 5 by 7 feet.

On account of the exhibit feature this convention is the largest, most important and interesting of the year with the exception of the combined conventions of the Master Mechanics and Master Car Builders in June.

A large number of supply concerns always exhibit at this convention and each year sees the latest devices and most improved machinery used in the track and engineering departments. There are always new and interesting devices shown and explained and this feature alone more than repays the railroad officials for attendance at the convention. Devices and machines can be seen here where it would be impossible to show them in distant parts of the country and at the same time railroad officials make the acquaintance of manufacturers



SECOND FLOOR PLAN, AUDITORIUM HOTEL, SHOWING EXHIBITION SPACE DURING CONVENTION OF THE AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION.

nominations for next year's officers have been made already. As a nomination is equivalent to an election with the association, next year's officials can be announced at this time. They are as follows:

President—A. W. Johnston, General Manager of the Nickel Plate, Cleveland.

Vice-President—W. McNab, Assistant Engineer of the Grand Trunk at Montreal.

Directors—L. C. Fritch of the Illinois Central, and W. G. Besler of the Central Railroad of New Jersey.

Treasurer—W. S. Dawley.

Secretary—E. H. Fritch.

It was thought last year that the parlors of the Auditorium Hotel would be too small to accommodate the exhibits another year on account of the increasing number of exhibitors. However, the amount of space allowed to each exhibitor has been reduced, so that with a larger number of rooms which exhibitors will be allowed to use will give ample space for this year. Space on the and other railroad men which promotes the exchange of ideas for mutual benefit and advantage.

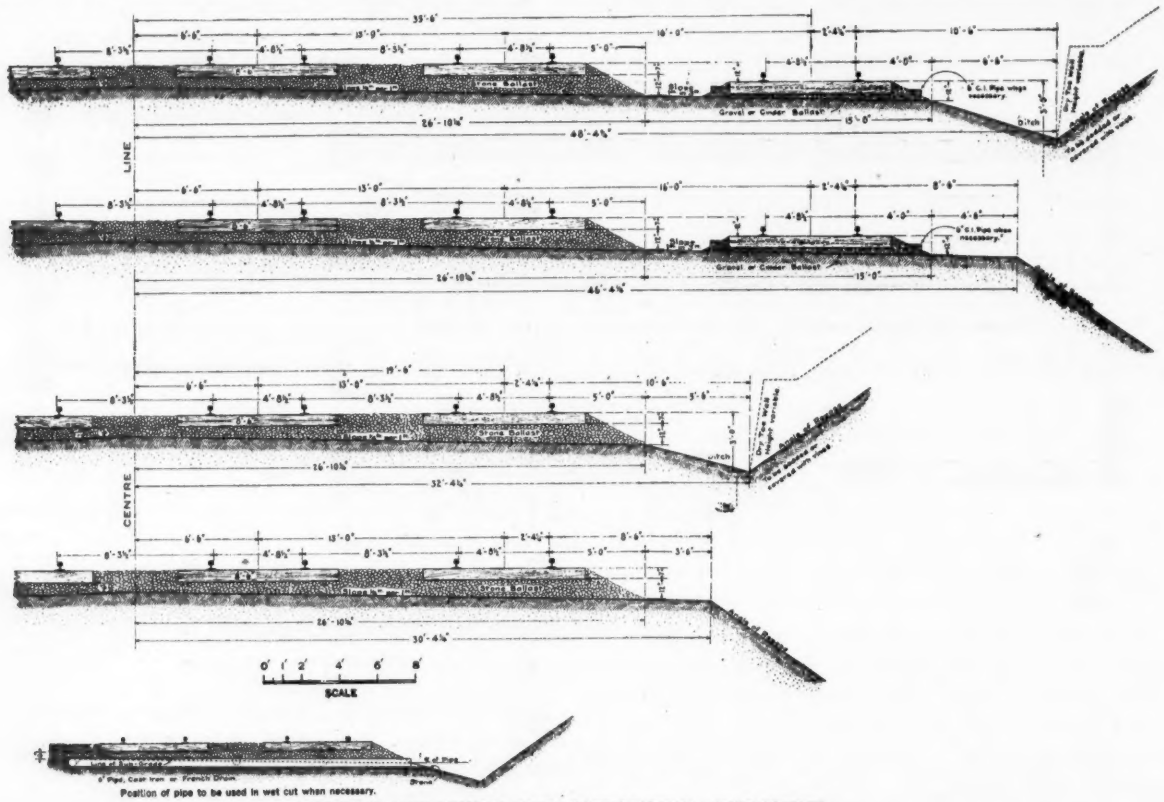
MR. WILSON E. SYMONS, President of the Pioneer Cast Steel Truck Company, 9114 Postal Telegraph Building, Chicago, addressed the Engineering Assembly of Purdue University, Lafayette, Ind., on January 21. Mr. Symons chose for his subject "Theory versus Practice in the Work of the Mechanical Engineer." Drawing upon an extensive personal experience, he presented his subject in a manner which was most interesting and instructive to his student audience. He described the helplessness of a man trained in theoretical matters only, discussed with care and discrimination the limitations which surround one whose entire stock in trade is his practical experience, and drew a fine picture of the opportunities which await the one who combines the theoretical with the practical. Such a combination he regarded as essential to the development of the ideal engineer.

Standard Roadway on the Pennsylvania R. R.

THE February number of Railway Engineering contained an editorial discussing improvements of roadbed. Continuing this subject we present herewith several illustrations showing portions of the new four-track standard roadway of the Pennsylvania railroad, together with a description of the same. To the eye of the casual observer the most notable feature of the new standard roadbed is the grass bank that slopes down to the tracks, when the latter are in a cut. Besides the turfing, which serves the double purpose of preventing erosion and presenting a good appearance, there are other features that make this standardizing of the roadbed an interesting project to railroad men. The first and all-important object of the improvement is perfect drainage.

The return is expected to come in the saving of maintenance expenses. As it is, laborers have to be continually busy on the roadbed, clearing ditches of all kinds of obstructions and putting in new ballast where it is necessary. Aside from the cost of labor which is considerable, work trains must use the main tracks and inevitably get in the way of both passenger and freight trains which retards the movement of traffic.

The standard ditch on the side is of ordinary soil, but the company has tried the experiment of sprinkling it with oil. This keeps dust down and weeds from growing. As far as freedom from obstructions is concerned, the grass banks have come fully up to the expectations in that respect. When it rains the water pours down



STANDARD PENNSYLVANIA FOUR-TRACK ROADWAY. HALF-SECTION.

Every maintenance of way engineer knows that water is the roadbed's greatest enemy. When the engineer has devised a means of carrying off water without letting it wash away or undermine the road bed, he has nearly solved the problem. Water flowing down unsodded slopes causes erosion as well as washing dirt and stones into the ditches below, which clogs the passage for drainage. Ditch-building plays a big part in making the ideal roadbed, for both the depth and the slope of a ditch are important factors. Keeping it clear for the flow of water is the function of the sodded banks. The cost of sodding with blue grass was very high. The engineers calculated that 58 per cent. of the total cost of change was for cutting down weeds and sodding the slopes.

over them without bringing anything with it and follows the ditch to the nearest outlet.

A detailed cross-section of the various roadbeds established as standard on the Pennsylvania R. R. are shown in the accompanying line engravings. The first two engravings give the details of one-half of the four-track standard roadway, with an industrial spur on one side, which is used in a cut and on a fill as required. The remaining engravings give similar detailed illustrations of the roadway omitting the industrial spur.

It will be noticed the sub-grade under the main tracks is built with a slope of ¼-inch to one foot while under the siding it has a slope of one inch to 3 feet, which affords a slow and efficient drainage for the roadbed. In

PENNSYLVANIA STANDARD ROADWAY IN CUT.

addition to this slope, six-inch cast iron drain pipes are placed at different intervals over the road, especially where the drainage is excessive, to take care of the water. This piping slopes gradually from the center of the roadbed to the outer edges parallel to the ties on a line slightly below that of sub-grade. Stone work is built at the mouth of the piping which does away with the liability of the water washing out a gully.

The ballast for the main track is of crushed stone and is laid to a depth of 13 inches in the center and 19 inches at the extremities. Eighty thousand cubic yards of new ballast was laid not because the road needed re-surfacing, but for the purpose of aiding drainage. There are 11,632 cubic yards of stone ballast for every mile of the standard four-track roadbed. An average depth of twelve inches of ballast is used on all sidings which may be of cinders, gravel or whatever other materials may be on hand. The ties used on the main track are 8 feet, 6 inches long and are embedded into the ballast 7 inches, which makes the top of the tie flush with top of ballast, these making a very substantial and neat track. This construction, which has 16 ties to every 33-foot rail, when well kept up, obviates all danger of hollow rail caused by improper tamping.

PENNSYLVANIA STANDARD ROADWAY.

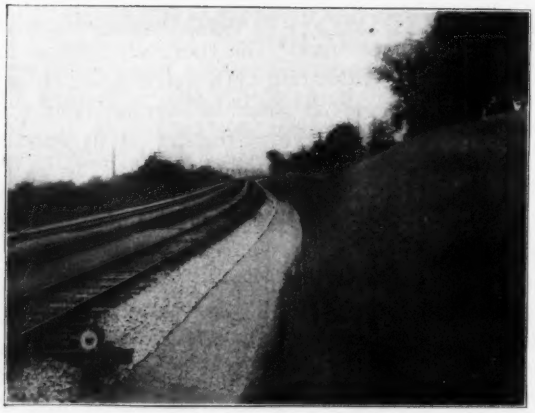
The Pennsylvania Railroad requires on its standard four-track roadway in a cut that the base line of the ditch, or the toe of the slope, be 10 feet, 6 inches from the outer gauge line on the outer track, as well as 3 feet below the base of the rail. This allows ample space for a large ditch to carry off all drainage. A toe-wall, which is shown in dotted lines on line engraving may be built, providing the ground is sufficiently plastic or rocky, with a steep slope which starts from the base of the ditch, thereby doing away with considerable turfing. Should the material on the slope be in a segregated condition the banks will require a smaller angle of repose. The plans also provide for berm ditches which are to be cut at the top of the slope. The standard roadway is 64 feet, 8½ inches from ditch to ditch, while the ballast section is 53 feet, 8½ inches in width. Main tracks are lined up 13 feet from center to center, while sidings are built at a minimum distance of 16 feet from the nearest main track. In yards and on sidings 14 ties are used for every 33-foot rail.

PENNSYLVANIA STANDARD ROADWAY IN ROCK CUT

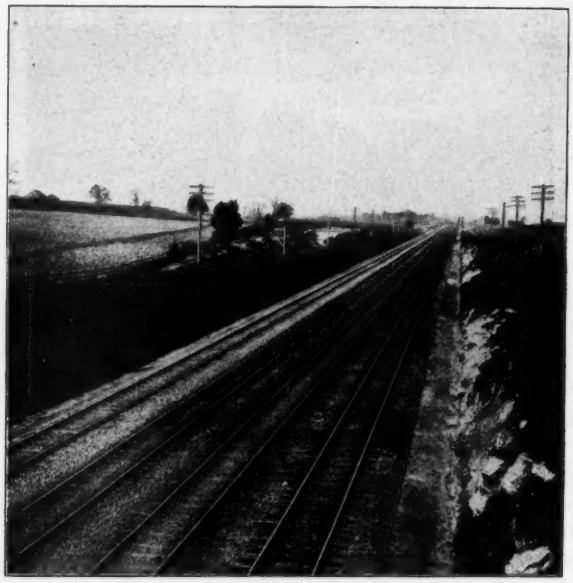
On a fill the standard roadway is 60 feet, 8½ inches from shoulder to shoulder of sub-grade while the dimensions of the ballast cross-section is the same as in a cut. The matter of drainage is generally taken care of by cast iron pipes, culverts, bridges, etc. It will be noticed that the roadway is larger through cuts than on fills due to the fact that the drainage must be carried away by ditches, built at the sides.

There are standards for single and double-track as well as for the four-track roadway. For a single track, the ballast is 15 inches deep in the center and 17 inches at the extremities making a total of 2,629 cubic yards to the mile. On double-track the distance from the toe of the slope to the center line of the roadbed is 18 feet, 4½ inches. The stone ballast is 13 inches deep in the center and 17 inches at the extremities, making a total of 5,127 cubic yards to the mile. The tracks are lined up 13 feet from center to center.

The accompanying pictures were taken at different places along a stretch of the four-track roadway located



PENNSYLVANIA STANDARD ROADWAY SHOWING GRASSY SLOPE.



PENNSYLVANIA STANDARD ROADWAY.

east of Pittsburg. An idea can be formed of the improved condition of the roadway which exists where this standard is in vogue.

The experiment with the first fifteen miles of standard roadway has proven so successful that the Pennsylvania has already made plans to improve much more of the main line in the same way. The work will go on steadily in the future, so that eventually the main line from Philadelphia to Pittsburg will be standardized.

Communications

Expansion of Steel Rails

Editor, Railway Engineering:

Permit me to make use of your Question and Answer Department. I had an argument the other day with another foreman who claimed that light steel rails expanded more during hot weather than heavy ones. I claim that all rails, and for that matter, all steel, expands at the same ratio, no matter what the thickness or cross section might be; will you please throw some light on this subject in your next issue, and oblige, S. J.

Section Foreman.

Mr. S. J. is right, generally speaking, but there are some fine points to be considered, which will modify results, and which tend to explain some seeming contradictions.

It is a general law in nature that, when the temperature of any substance rises, it expands, or in other words, it occupies a larger space; this expansion takes place in all directions. Careful investigations and measurements for various substances have been made and tables prepared showing how much the unit expands for a unit increase in temperature. Such numbers are called expansion coefficients and remain the same for the same kind of material. For instance, a copper rod 1 foot long expands .000115 inches for an increase in temperature of one degree; then a copper rod 100 ft. long expands 100 times as much for one degree, or .0115 inches, and if the increase in temperature be 80 degrees then the expansion would be 80 times that of the one degree; therefore a copper rod 100 ft. long and having been subjected to an increase in temperature of 80 degrees F., would suffer an expansion of: 100x80x.000115=.92 inches. So the rod would measure 100 feet plus .92 inches after expansion.

In like manner the expansion coefficients for most all other substances have been prepared and embodied into tables.

The expansion coefficient for iron is .00008, for steel rods .000076, for cast steel .000072, for tempered steel .000083, and for Bessemer steel .0000719. Now it must be understood that there is a great variation in the composition of various kinds of steel and that a difference in the composition will affect the expansion coefficient. In reference to steel rails it is known that the elements, iron, carbon, manganese and silica enter into their composition, and it is observed that the expansion coefficient decreases with the increase of these secondary substances. Thus a steel composed of 98.89% of iron, .51% of carbon, .58% of manganese and .02% of silica has an expansion of .000079 inches per foot degree F., and a steel containing 97.95% of iron, .97% of carbon, .80% of manganese and .28% of silica expands .000074 inches per lineal foot per degree F. If rails 33 ft. long be rolled from these two classes of steel and the expansion be computed for them for a difference of temperature of 100 degrees F., then the expansion for the first rail would be 33x100x.000079=.26 inches. For the second kind of steel it would be 33x100x.000074=.24 inches.

Here then, is a case where two steel rails would show a measurable variation in their expansion, but the size has obviously nothing whatever to do with it; they are merely composed of different substances, each quality having its own expansion coefficient.

As in rails, only the linear expansion is considered; it

is easily seen that the cross section of the rail has nothing to do with that, and telegraph wire will show the same elongation as a rail weighing 100 lbs.; per yard, providing they are rolled of the same metal, have the same length and the same temperature influence.

When renewing rails it is quite essential that the foreman in charge makes provision for proper expansion between the rails. There is but one right way, and giving too much expansion is as bad as giving too little. Therefore the foreman must have the right experience and use good judgment. If the weather is very hot and the rails have been exposed to the sun, they may be laid without the use of expansion shim, by merely letting the ends touch each other. Even then care must be taken, and perhaps every third joint should have the smallest expansion shim, say 1-16 inch. The temperature should be constantly watched and as the mornings and evenings are usually cooler than the middle of the day the rails should be laid with the required expansion shims. A good rule, where the maximum temperature can be taken as 100 degrees F., is to lay such rails with 1-16 inch expansion; the same rails should then be laid with 5-16 inch expansion shims at the temperature of zero. Now it is easy to figure shims for intermediate temperatures; thus for every 25 degrees F. difference add 1-16 inch, so at 75 dgrees F. use a ⅛ inch, at 50 degrees use a 3-16 inch, and at 25 degrees F., use a ¼ inch shim. At 37 degrees F. every other joint should have a 3-16 inch and ¼ inch shim, so as not to get too many kind of shims, though the exact shim should be 7-32 inches.

Ties Embedded in Concrete

THE increasing demand for railroad ties and the diminishing supply of timber from which good ties may be made, directs attention to preservatives for wooden ties as well as substitutes for wood. In street railway service excellent results have been obtained with cedar ties embedded in concrete and it is of general interest to note the method by which these ties were laid and the effect produced on the life of the ties by such treatment.

The following communication describes the practice of the Toronto Street Railway Company and gives the results obtained by this company:

Editor, Railway Engineering:

In 1892 the city of Toronto purchased from the Toronto Street Railway Company their plant and afterwards leased the same for a period of thirty years to the present company, under certain conditions, with which your readers are probably familiar. During the same year the company commenced turning the old horse car line into an electric line, and the city at that time put down a permanent pavement on the track allowance, the company laying the cedar ties and rails. The ties were spaced in the usual way and laid on gravel or sand and in some cases placed on natural soil. The city then placed concrete between the ties and under the rails and on top of this concrete placed either asphalt or some other paving material.

On various occasions, in examining or making repairs, we have had an opportunity of examining these ties and in every instance have found them in a good condition. We examined some last fall and not one was found decayed. A great many of them are full of moisture.

I may say, however, that in the last few years we have discontinued placing wooden ties under the rails and now construct a solid concrete beam, using steel tie-bars.

Yours truly,

C. H. RUST,
City Engineer.

Toronto, Ontario.

Cinder Pit at El Paso, Tex.—El Paso & Southwestern Ry.

THE February number of Railway Engineering contained an illustrated article descriptive of the new shops of the El Paso & Southwestern Railway at El Paso, Tex. An interesting feature of this plant, not described in the previous article is the cinder pit for knocking out fires and cleaning ash pans. The general appearance of this pit is illustrated by the accompanying half tone engraving from a photograph taken during construction, and designated as Fig. 1. The principal details of interest are illustrated by Figs. 2 and 3. The pit is designed to cover two tracks and between these is a loading track depressed to a depth of 5 feet 11 inches. The pit is of concrete wall construction with a reinforced concrete floor. It is 82 feet long and the floor from the side wall to the depressed tracks is 10 feet wide. The

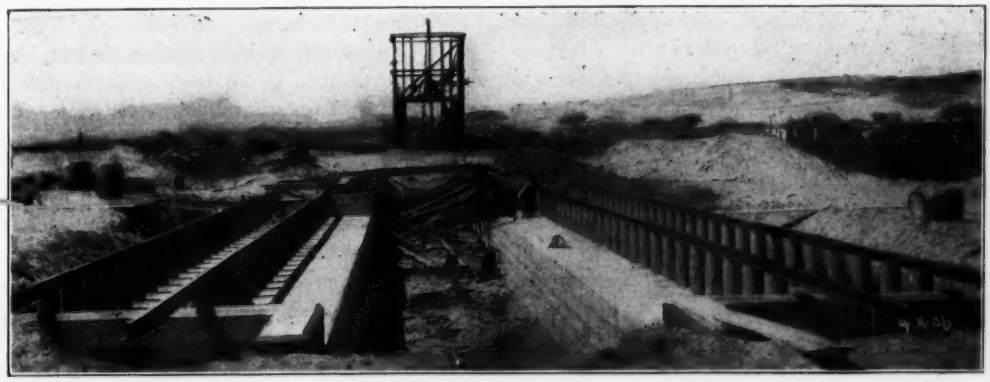


FIG. 1.—CINDER PIT DURING CONSTRUCTION—EL PASO & SOUTHWESTERN RY.

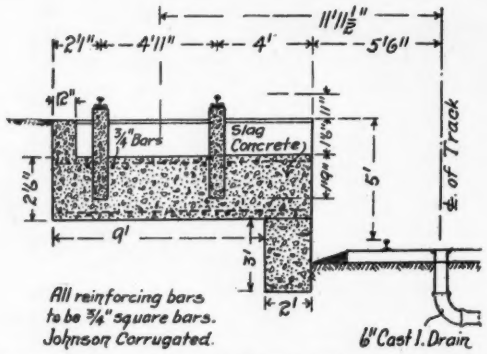


FIG. 2.—HALF-SECTION OF CINDER PIT—EL PASO & SOUTHWESTERN RY.

floor is of slag concrete 2½ feet deep, reinforced 3 inches under the top surface and 3 inches above the bottom with ¾ inch Johnson corrugated square bars, placed 12 inches apart and arranged both longitudinally and transversely.

The track rails are supported upon cylindrical cast iron pedestals, standing 3 feet apart between centers. Each pedestal is 8½ inches outside diameter and the cylinder is filled with concrete. The arrangement of the rail seat on the pedestal and of the stub bolt fastenings is of unusual interest and is clearly illustrated by Fig. 3.

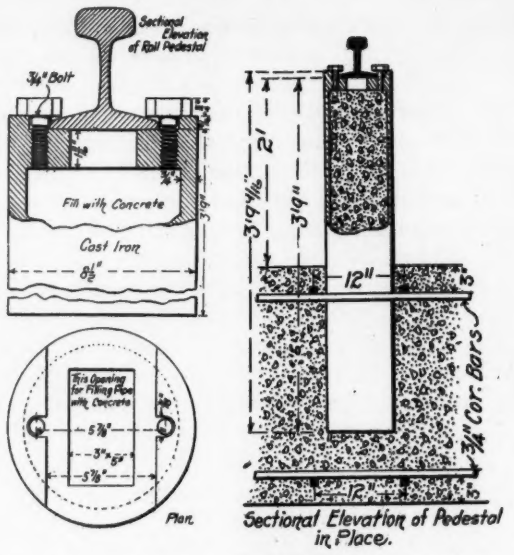


FIG. 3.—DETAILS OF PEDESTAL FOR CINDER PIT RAIL—EL PASO & SOUTH WESTERN RY.

The depression for the loading tracks is drained by a line of 6-inch cast iron pipe.

New Hoboken Terminal

Delaware, Lackawanna & Western R. R.

THE first of the great railway terminals that are to grace New York was opened to the public by the Lackawanna Railroad Co., on February 24th.

Besides being the first great terminal to be opened, it has the distinction of being the best arranged water front railway terminal in the world, having a frontage of 730 feet upon the Hudson river.

The terminal itself is unique in many respects. It is built upon new engineering and architectural lines, there being none like it in existence. It was built over traffic, 100,000 people using the terminal daily during its construction without the loss of time or a single injury. It is built over water, its concrete and steel foundation resting upon piling; its system of train sheds is absolutely original, designed by the chief engineer of the company. These are a few of the most interesting features.

Not to go deep into statistics or ancient history, on the night of Aug. 8, 1905, the Hoboken terminal and ferry houses were burned to the ground. Before the last flame had flickered out, plans were being drawn for a temporary terminal. In a few days the temporary structure was in place.

On March 25, 1906, the first actual concrete construction was commenced and on February 3, 1907, the entire station except three of the ferry slips was finished and opened to the public. The quick construction of the terminal, going on over the traffic of 100,000 people and 3,600 teams daily, is representative of excellent engineering work.

The Lackawanna terminal is absolutely fireproof; even the racks and desks in the ticket offices are of metal.

On the first floor will be found the waiting room and its dependencies; also the ferry concourse. The waiting room is 90 by 100 feet and 55 feet high; it is finished in limestone and plaster, with high windows on all sides, and a leaded ceiling light in art glass. At night this room will be lighted by 1,000 incandescent lights. Four bronze chandeliers weighing one ton each will hang one in each corner; brackets around the sides, and canopies on the seats, will be the new and novel lighting scheme. In the waiting room will be found the very ornamental bronze stairways leading to the ferry concourse. The general design of the decorations is the Louis XVI style. Opening off from the waiting room will be found commodious women's rooms and smoking rooms, information bureau, lunch room, telephone booths, baggage, express and news stand.

On the second floor, reached by an easy inclined plane by stairways and elevators, will be found the restaurant, a fully equipped emergency hospital, a barber shop and bath rooms, and necessary offices.

The most ornate room in the new terminal will be the restaurant, finished in old ivory with old-gold hangings and French gilt fixtures, all the wood-work being of mahogany. The restaurant, seating over 250, overlooks the water, and gives its patrons a fine marine view. An outdoor balcony seating 45 will be utilized in the summer. This will allow patrons while enjoying lunch or dinner to see the busiest harbor in America at its best.

The ferry approaches have been made with the purpose in view of furnishing convenient facilities for the patrons of the Lackawanna. Three pair of slips, each accommodating two double-decked ferry-boats, serving 23rd. Christopher and Barclay Streets, have been provided. To

reach the ferry-boat there is a concourse 70 by 100 feet, with rows of coupled columns and heavy ornamental beams across the ceiling, to the upper deck. To reach the concourse passengers have the choice of three ways, an easy inclined plane, a stairway and elevators. The waiting rooms and ferry concourse have a joint capacity to safely shelter 40,000 people.

The architectural and artistic features are numerous, but the principal ones are that the building will be covered with copper. A tower 225 feet high rises from the central facade.

The highly ornamental tower supports the largest clock in the harbor, it being twelve feet in diameter.

The tower by day carries a flag that can be seen for many miles up and down the river. At night it is illuminated from top to bottom with electric lights, making it a conspicuous feature of the Hudson. The six ferry slips are spanned by arches supported by ornamental piers, all of which are pricked out at night by electric lights, making an attractive picture.

The street elevation of the ferry house will have, when completed, five bays surmounted by pediments and is also of copper. The baggage rooms and the first floor of the waiting rooms are of Indiana limestone, with copper work above. For light and ornament, 8,000 incandescent lights are used; of these 2,100 are employed in the five large electric signs, one having the letters "Lackawanna" each nine feet in height.

It is the best lighted and decorated of all terminals up to the present moment.

The train shed designed by the chief engineer of the Lackawanna railroad is of an entirely new type, built of steel, concrete and glass. There is a smoke opening over each track, that is an absolute novelty. The train sheds are made to cover fourteen tracks and are 607 feet in length.

The terminal will be heated and ventilated by the latest appliances. Warm fresh air in winter will be forced into various public rooms.

The emigrant station, having a ferry slip and building of its own, is capable of accommodating 800 people. It is built so as to be kept in an absolute sanitary condition; it is served with its own ferry-boat, direct from Ellis Island, and its own car tracks.

Mr. Kenneth Murchison is the architect, Mr. L. Bush, chief engineer of the Lackawanna, is the designer of the foundation and train shed.

Prices of Track Materials, F. O. B. Chicago

TRACK SUPPLIES.

	Retail price per cwt.	Mill price.
Steel Rail, 60 lbs. and over...		$28.00 per gross ton
Steel Rail, 30 to 45 lbs...	$1.75	33.00 per gross ton
Steel Rail, 25 lbs.....	1.80	34.00 per gross ton
Steel Rail, 20 lbs.....	1.80	35.00 per gross ton
Steel Rail, 16 lbs.....	1.80	36.00 per gross ton
Steel Rail, 12 lbs.....	2.10	37.00 per gross ton
Ties, 6x8x8 oak, 1st grade.....		75c. each
Ties, 6x8x8 oak, 2d grade.....		60c. each
Switch Ties		$30.00 M. ft.

Angle bars, accompanying rail orders, 1907 delivery, 1.65c.; car lots, 1.90c. to 1.95c.; spikes, 2.40c. to 2.50 c., according to delivery; track bolts, 2.75c. to 2.85c., base, square nuts, and 2.90s. to 3c., base, hexagon nuts. The store prices on track supplies range from 0.15c. to 0.20c. above mill prices. Switch set per turn out, $175 to $200.

OLD MATERIAL.

	Per Gr. Ton.
Old Steel Rails, 4 ft. and over.....	$19.00 to $19 50
Old Steel Rails, less than 4 ft.....	18.00 to 18.50
Old Iron Rails	25.00 to 26.00

SHEET STEEL.

It is quoted for future delivery: Tank Plate, ¼-in. and heavier, wider than 6¼ and up to 100 in. wide, inclusive, car lots, Chicago, 1.86½c. to 2.06½c.; 3-16 in., 1.96½c. to 2.16½c.; Nos. 7 and 8 gauge, 2.01½c. to 2.21½c.; No. 9, 2.11½c. to 2.31½c.; Flange quality in widths up to 100 in., 1.96½c. to 2.06½c., base, for ¼-in. and heavier, with the same advance for lighter weights; Sketch Plates, Tank quality, 1.96½c. to 2.16½c.; Flange quality, 2.06½c. Store prices on Plates are as follows: Tank Plate, ¼-in. and heavier, up to 72 in. wide, 2.20c. to 2.30c.; from 72 to 96 in. wide, 2.30c. to 2.40c.; 3-16 in., up to 60 in. wide, 2.30c. to 2.40c.; 72 in. wide, 2.55c. to 2.65c.; No. 8, up to 60 in. wide, 2.35c. to 2.45c.; Flange and Head quality, 0.25c. extra.

STRUCTURAL STEEL SHAPES.

Store quotations are unchanged at 2.05c. to 2.10c., and mill prices are as follows: Beams and Channels, 3 to 15 in., inclusive, 1.86½c.; Angles, 3 to 6 in., ¼-in. and heavier, 1.86½c.; larger than 6 in. on one or both legs, 1.96½c. Beams, larger than 15 in., 1.96½c.; Zees, 3 in. and over, 1.86½c.; Tees, 3 in. and over, 1.91½c., in addition to the usual extras for cutting to extra lengths, punching, coping, bending and other shop work.

CAST IRON PIPE.

Quotations per net ton on Water Pipe, 4 in., $38 to $39; 6 to 12 in., $37 to $38; 16 in. and up, $36 to $37, with $1 extra for Gas Pipe.

CEMENT.

	Package.
Good grade Portland Cement.....	$1.85 in wood 1.65 in paper *1.85 in duck

*(Duck sacks credited when returned.)

SAND.

Bank sand	$0.60 per yd.
Torpedo sand	1.10 per yd.

CRUSHED STONE AND GRAVEL.

Crushed limestone	$1.10 per yd.
Crushed gravel	1.00 per yd.

Coaling Station at Toledo, O.

L. S. & M. S. Ry.

THE railroads have long since realized the necessity of modern facilities for handling locomotives with comparative ease and rapidity at terminals, and among other improvements they are rapidly replacing the old style trestle approach coal chutes by plants of modern design. It would seem to approach the ideal if one style of coaling station could be built which would answer at all terminals, but such is not practical for the reason that conditions which prevail at one terminal are considerably different from those of another; for instance, the amount of space available, location, number of engines to be coaled, kind and size of coal used, kind of cars in which coal will be received (whether hopper bottom or not) condition of weather (coal freezing in pockets, etc.)

The Lake Shore & Michigan Southern Railway has recently erected a 300-ton locomotive coaling station at Toledo, Ohio, which is admirably adapted to existing conditions. A general layout of the tracks showing the location of the coaling station, roundhouse, cinder pit, sand house, etc., is shown by Fig. 3. It will be noticed that the entire layout is conveniently arranged with respect to the roundhouse in order to facilitate the movement of locomotives.

Coal for this station is received in hopper bottom cars, which are spotted over the pit located just north of the coaling plant. The coal is then dropped into this pit or hopper and carried by a system of conveyor buckets to a large storage pocket located at the top of the building. The conveyor buckets in making their circuit, pass through a steel tube of ample space to allow of easy operation. There are two systems of buckets operating independently and it is therefore necessary to have two tubes. These tubes extend the full height of the building and are placed on the side next to the hopper. This is

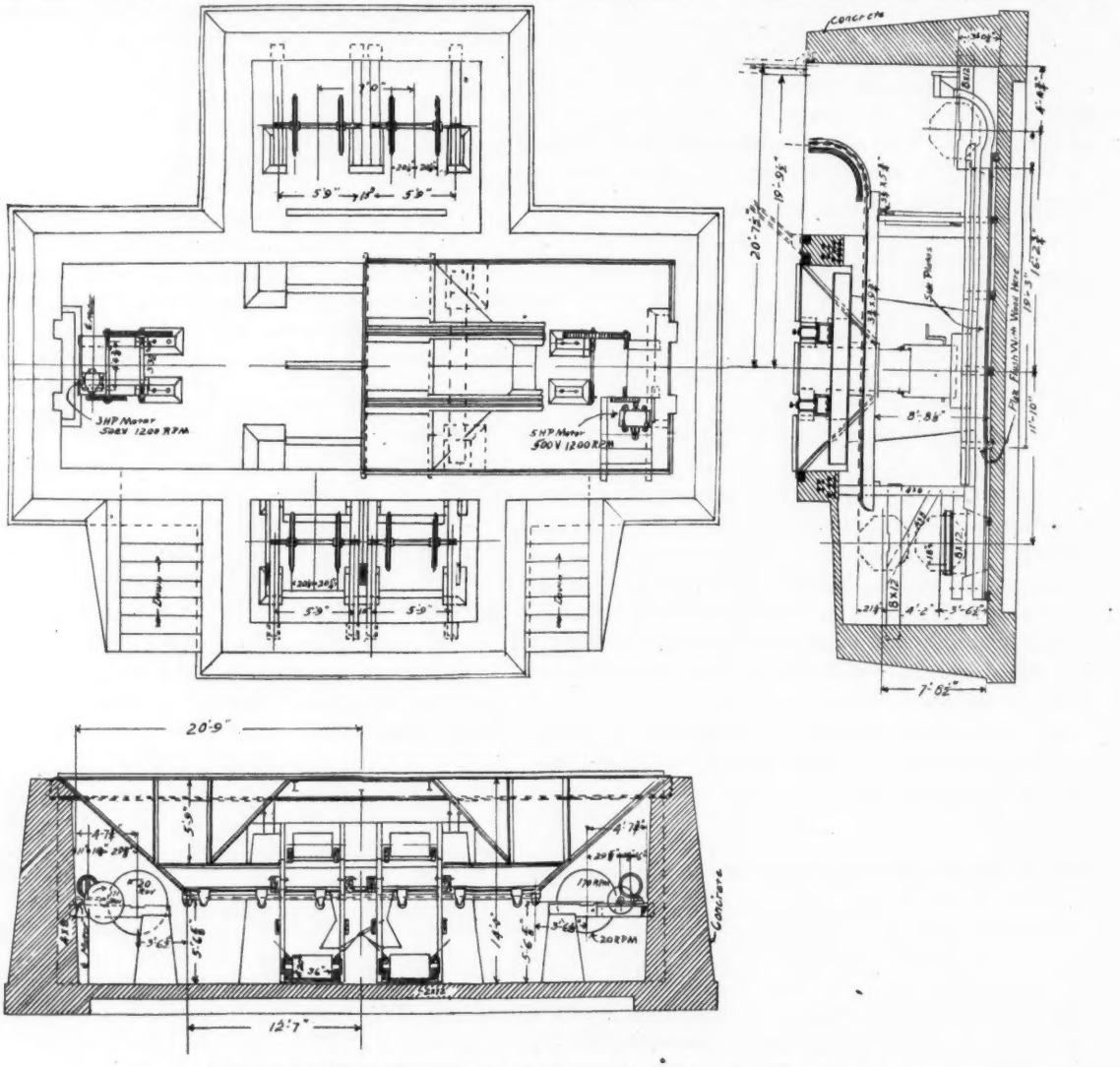


FIG. 1.—PLAN AND SECTIONAL ELEVATIONS OF HOPPER PIT—L. S. & M. S. TERMINAL, TOLEDO, O.

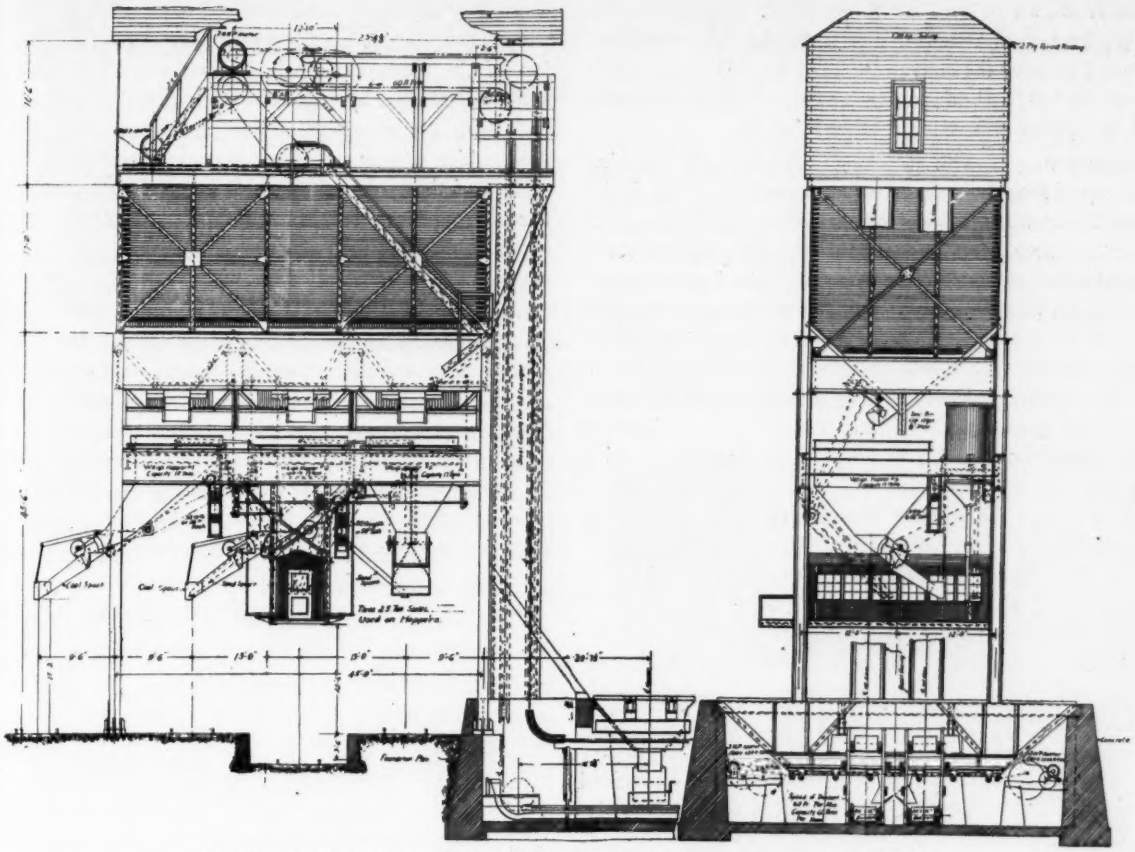


FIG. 2—SECTIONAL ELEVATION OF COALING STATION—L. S. & M. S. TERMINAL, TOLEDO, O.

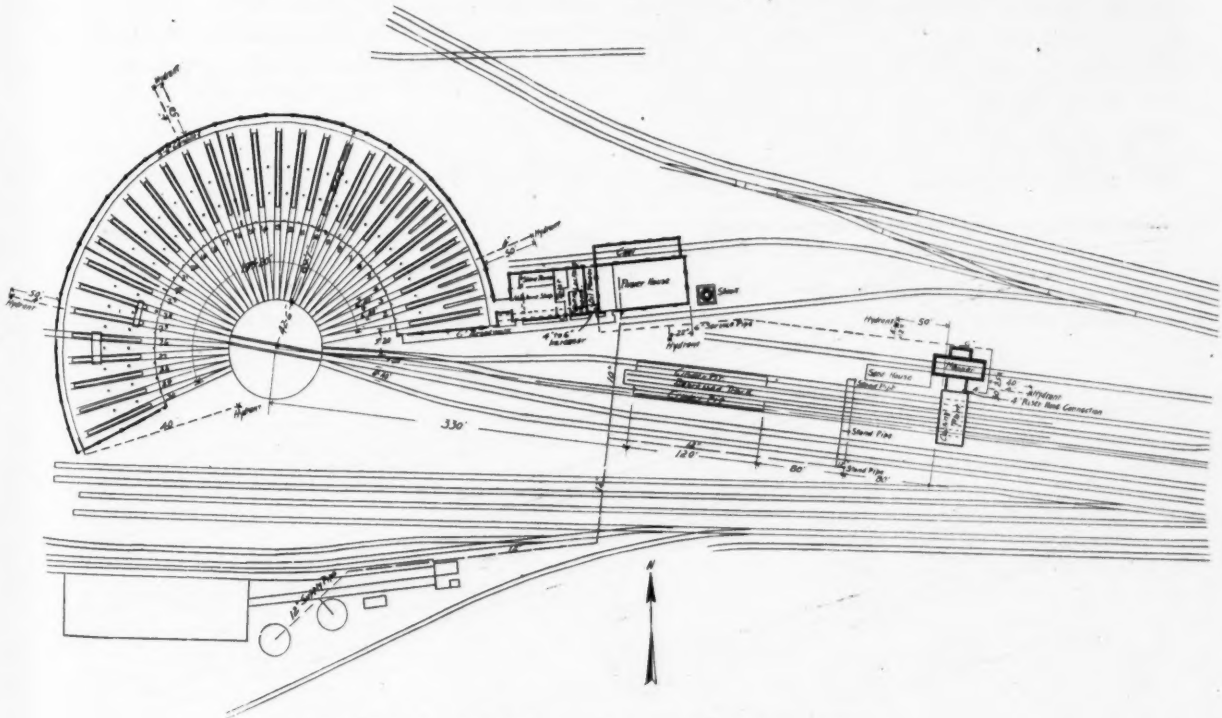


FIG 3.—GENERAL PLAN OF L. S. & M. S. RY. TERMINAL AT TOLEDO, O.

clearly shown in Fig. 2. A 20 H. P. General Electric compound wound motor, located in the upper housing, is used to drive the conveyors. The normal speed of this motor is 650 R. P. M., and by a system of gears the speed of the conveyor is reduced to 60 R. P. M.

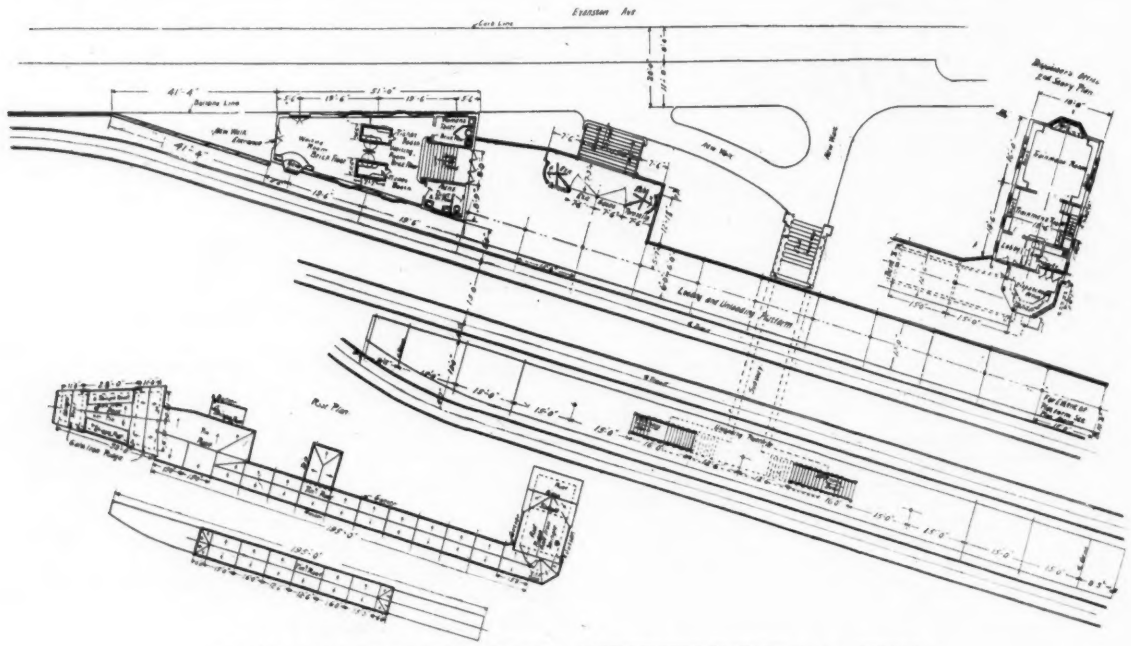
The conveyor with its loaded buckets upon reaching the top of the tube is diverted horizontally to a trip device which is changed at intervals to different positions, so as to cause the buckets to dump their contents automatically in different portions of the pocket. These buckets are of the G. D. S. type, size 20x36 inches and manufactured by the Link Belt Company. After the supply of coal is transferred to the upper pocket a limited amount is allowed to pass down by gravity when needed through a series of gates into weighing hoppers. These hoppers are illustrated in Fig. 2 and are numbered 1, 2 and 3 respectively. Hopper number 1 has a weighing capacity of 15 tons while hoppers 2 and 3 are of 17 tons each. Three 25-ton Monarch weighing scales are used for this work and the readings are made by a man located in the suspended house under the coaling plant. The coal after being weighed and proper notations made, is then delivered to the locomotive tender by a chute similar in construction to the ordinary water spout used on water tanks. The chutes are suspended in equilibrium with a series of weights, an arrangement which makes it easy for the man on the tender to handle. It will be noticed that the middle track under the coaling station is depressed 3 ft. 6 in. to allow for clearance under the suspended house.

A plan and sectional elevation of hopper bottom coal pit is illustrated by Fig. 1. All foundations, abutment walls, conduits, etc., are built of concrete and in some places they are re-inforced with old rail. This pit is devoted entirely to the machinery necessary to aid the operation of the conveyors, coal hoppers, etc. The coaling station, illustrated by Fig. 2, is constructed of structural steel, with the exception of the housing on top of the plant, which is built up of one-inch drop siding, and the interior of the coal pocket which is lined with planking. The plant is covered by a two-ply paroid roofing.

The sand house is located west of the coaling station where the excess supply of sand is stored prior to its being placed into the sand bin. The sand is delivered by gravity directly to the locomotives from the bin which is built in connection with the coaling station. This addition is worthy of more than passing interest as it shows an economical feature which does away with one spotting of the engine at the sand house, necessary at most stations of the older style. As the capacity of this bin is limited to 10 yards it was necessary to provide additional room to take care of the surplus sand generally purchased in large quantities.

The cinder pit is 160 feet west of the coaling plant and is so situated that the operation of either the plant or the pit offers no interference with the other. The cinder pit is of the old style in which cars are loaded by hand and this arrangement is proving very satisfactory in modern practice. The bottom and sides of the pit are of concrete.

The equipment and conveyor for this plant was furnished by the Link Belt Machinery Co. We are indebted to Mr. R. O. Rote, Prin. Ass't. Engr. L. S. & M. S. Ry., Cleveland, Ohio, and the Link Belt Co., of Chicago, for prints and information incorporated in this article.



PLAN OF WILSON AVENUE SURFACE STATION—NORTHWESTERN ELEVATED R. R., CHICAGO.

Wilson Avenue Terminal of the Northwestern Elevated Railroad, Chicago

THE Northwestern Elevated Railroad of Chicago is making extensive improvements at its Wilson avenue terminus to meet the demands for additional facilities required by the increasing traffic. This railroad serves that portion of the city of Chicago lying north of the business center and along the shore of Lake Michigan. Since the construction of the Northwestern Elevated the portion of the city which it serves has grown rapidly and additional facilities are necessary in order to move trains more rapidly.

The present terminus includes three platforms on the elevated structure serving four tracks, and one platform on the surface serving a single track used during the rush hours. Inasmuch as it is necessary for trains to depart from the present platform before incoming trains can approach, much congestion results during the rush hours, and incoming passengers are frequently delayed more or less by this congestion.

To provide for dispatching trains more rapidly a loop has been built on the surface, which is connected with the tracks on the elevated structure by an inclined approach on each side. Thus it will be possible for trains to follow each other around the loop to the platforms, and as the passengers are discharged, ascend again to the elevated tracks and continue to the city without being delayed by switching at the terminus.

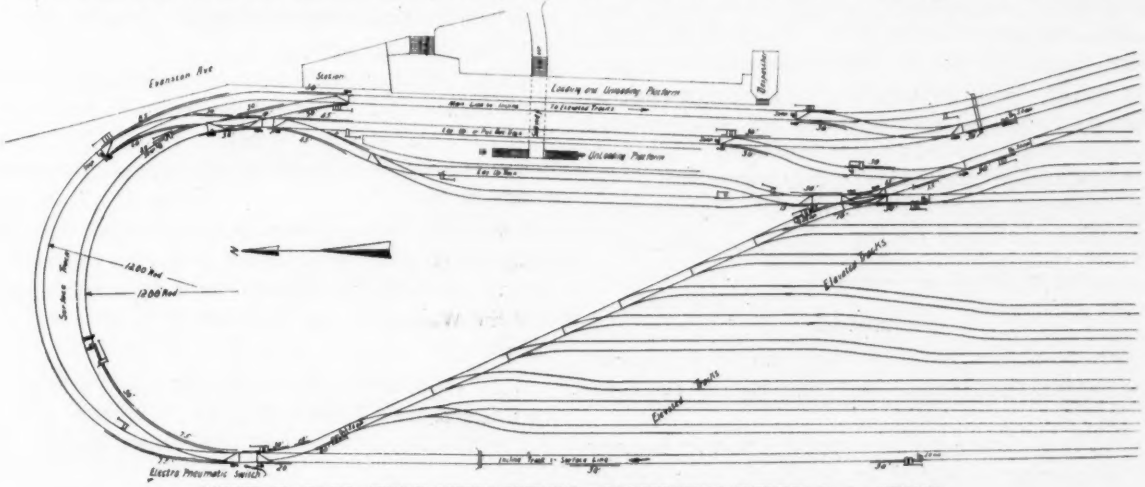
The track by which trains descend is on the west side of the elevated structure, while the track by which they ascend is on the east side, and the loop passes directly under the present elevated platform. The general lay out of both the elevated and surface tracks is shown by the accompanying plan.

Station accommodations include two long narrow platforms serving three tracks. One of these platforms is in connection with a station building containing a waiting room, ticket office, and the usual station requirements. This is adjacent to Evanston avenue. The second platform is situated between the tracks and is partially covered by an umbrella shed extending the length of the platform, for the protection of passengers in stormy weather. This platform is connected with the street by a subway passing under the tracks, and passengers are exposed to no danger either from approaching trains, or from contact with the third rail. This platform is used only for discharging passengers from trains coming from the city.

Passengers board trains from the east platform only, which is easily accessible from Evanston avenue, near

WILSON AVENUE SURFACE STATION—NORTHWESTERN ELEVATED R. R., CHICAGO.

Wilson avenue. Entrance is from the waiting room and past a ticket booth. Exit is through two turnstiles, and



LAYOUT OF TRACKS, WILSON AVENUE TERMINAL—NORTHWESTERN ELEVATED R. R., CHICAGO.

DECLINING TRACK TO WILSON AVENUE SURFACE STATION—NORTHWESTERN ELEVATED R. R., CHICAGO.

in case of crowds, further provision for rapid exit is by a gate 15 ft. wide.

Both platforms are built on driven pile bents placed 15 feet apart between centers. The platforms are of wood and simply constructed. As far as possible, they are provided with railings to guard the safety of the passengers. The station building is a frame structure. The exterior is covered with a combination plaster laid over expanded metal. All exposed wood work is stained and the building presents a neat and attractive appearance, as well as being durable.

All switches and dwarf signals are operated by a combined pneumatic and electric system. Air pressure is used to operate the switches and signals, and the valves controlling the flow of air are controlled electrically. An average air pressure of 80 lbs per square inch is provided and this pressure is found to meet all requirements effectually.

The rails in service are of heavy section and are secured to the ties with special spikes, especially adapted for service under the peculiar conditions prevailing at this terminus. All difficult curves are well protected with guard rails against possible derailments. Tie plates are used to distribute the load over a greater area on the tie, to prevent the rail from cutting into the timber and to prolong the life of the ties.

Personals

Mr. W. C. Edes has been appointed chief engineer of the Northwestern Pacific with headquarters at San Francisco, Cal.

Mr. R. M. Drake has been appointed district engineer of maintenance of way of the Southern Pacific with office at San Francisco, Cal., to succeed Mr. W. C. Edes, who resigned to accept service with another company. Mr. Drake has heretofore been resident engineer of the western division of the Southern Pacific at Oakland, Cal.

Mr. J. T. Westbrook has been appointed roadmaster of the Missouri Pacific at Sedalia, Mo., to succeed Mr. T. H. Baldwin.

Mr. H. E. Stevens has been appointed bridge engineer of the Northern Pacific with headquarters at St. Paul, Minn.

Mr. Lewis Howard Wheaton has been appointed engineer of maintenance of way of the Halifax & Southwestern with headquarters at Bridgewater, N. S.

Mr. Oscar Sublette has been appointed roadmaster of the International & Great Northern Ry., with offices at Taylor, Tex.

Mr. E. W. Newcomb has been appointed signal engineer of the Oregon Short Line, with headquarters at Ogden, Utah.

Mr. M. E. Eckert, roadmaster of the Chicago, Rock Island & Pacific at Estherville, Ia., has had his headquarters changed to Cedar Rapids, Ia.

Mr. E. D. Jackson, assistant division engineer of the Pittsburg division of the Baltimore & Ohio, has been appointed assistant engineer of maintenance of way, with office at Baltimore, Md.

Mr. A. A. Miller has been appointed division engineer of the Baltimore & Ohio R. R. at Philadelphia, Pa., to succeed Mr. William Trapnell, who has been transferred to Baltimore, Md., to succeed Mr. V. K. Hendricks, resigned.

Mr. E. G. Lane has been appointed engineer of maintenance of way of the Baltimore & Ohio R. R. at Pittsburg, Pa., to succeed Mr. H. H. Temple, promoted. Mr. Lane has heretofore been division engineer of maintenance of way of the same road at New Castle, Pa., and is succeeded at the latter place by Mr. A. M. Funk.

Mr. R. S. Parsons, heretofore engineer of maintenance of way of the Erie Railroad, at Cleveland, O., has been appointed assistant general superintendent of the same road, with headquarters at Cleveland, O., and the former office has been abolished.

Mr. J. C. Tucker, superintendent of the Erie Railroad, at Salamanca, N. Y., has been transferred to Rochester, N. Y., to succeed Mr. George W. Dowe. Mr. E. I. Bowen succeeds Mr. Tucker as superintendent at Salamanca, N. Y.

Mr. T. H. Bacon, assistant chief engineer of the Chicago Great Western Ry., St. Paul, Minn., has resigned.

Mr. C. A. Steele has been appointed assistant engineer of the Wabash Lines east of Toledo, with office at Canton, O.

Mr. C. M. Case has been appointed chief engineer of the Chicago, Rock Island & Gulf Ry., with office at Fort Worth, Tex., to succeed Mr. J. S. Peter, recently resigned.

The headquarters of Mr. D. L. Sommerville, division engineer of the New York Central & Hudson River R. R., have been moved from Buffalo to Syracuse, N. Y.

Mr. George R. MacLeod has been appointed resident engineer of the Grand Trunk Ry., with office at Toronto, Ont., to succeed Mr. F. L. Somerville, resigned.

Mr. R. R. Matheany, Jr., heretofore assistant engineer of the Pennsylvania Lines at Louisville, Ky., has been appointed assistant engineer of the Cincinnati & Muskingum Valley, with office at Zanesville, O., to succeed Mr H. W. Brown, transferred.

Mr. J. H. Scott has been appointed superintendent and chief engineer of the Tremont & Gulf, with office at Tremont, La.

Mr. James Russell, formerly superintendent of the Missouri Pacific at Omaha, Neb., has been appointed superintendent of the Chicago, Burlington & Quincy, with office at Beardstown, Ill.

Mr. Richard Elliott has been appointed assistant superintendent of bridges and buildings of the Nashville, Chattanooga & St. Louis, with office at Columbia, Tenn.

Mr. C. M. Hunt has been appointed superintendent of maintenance and transportation of the Pacific & Idaho Northern, with office at Weiser, Idaho.

Mr. C. H. Bevington has been appointed superintendent of the Missouri Pacific at Omaha, Neb., to succeed Mr. J. Russell, resigned.

Mr. B. G. Fallis has been appointed superintendent of the Southern Ry., at Charlotte, N. C., to succeed Mr. P. L. McManus, promoted.

Mr. W. A. Hill has been appointed superintendent of the Vera Cruz & Pacific, with office at Tierra Blanca, Mex.

Mr. H. M. Stone has been appointed assistant engineer of the Northern district of the Chicago, Rock Island & Pacific, with office at Cedar Rapids, Ia., to succeed Mr. Garrett Davis, transferred. Mr. J. G. Bloom, heretofore engineer of maintenance of way at Topeka, Kas., has been appointed district engineer of the Southwestern District, with office at Topeka, Kas.

Mr. L. M. Shipley, heretofore superintendent of terminals of the Chicago Great Western at Oelwein, Ia., has been appointed superintendent at Clarion, Ia., to succeed Mr. O. Cornelison, who has been appointed superintendent of transportation with office at St. Paul, Minn.

Mr. E. Ryder, formerly superintendent of the Chicago & Alton at Bloomington, Ill., has been appointed general superintendent of the Chicago, Indiana & Southern, with office at Chicago.

Mr. John McGie, heretofore master mechanic of the Chicago, Rock Island & Pacific at Little Rock, Ark., has been appointed superintendent at Geary, Okla.

Mr. W. Rudd has been appointed superintendent of the Chicago, Rock Island & Pacific at Haileyville, I. T.

Mr. J. B. Shaw has been appointed superintendent of the Licking River Railroad, with office at Yale, Ky.

Mr. E. Dailey has been appointed superintendent of the Illinois Central at Freeport, Ill., to succeed Mr. A. E. Clift, who has been transferred to Carbondale, Ill., to succeed Mr. C. L. Ewing, promoted to be general superintendent at Chicago.

Mr. A. Price has been appointed general superintendent of the Western Lines of the Canadian Pacific to succeed Mr. G. P. Bury, who has been promoted to the new office of assistant general manager of the Western Lines, both with offices at Winnipeg, Man.

Mr. A. H. Dakin has been appointed terminal engineer of the Lehigh Valley Ry., with headquarters at New York City. Mr. Dakin has heretofore been assistant engineer of the Central Railroad of New Jersey, at Jersey City, N. J.

Mr. L. G. Curtis, who has been division engineer of maintenance of way of the Baltimore & Ohio at Chicago, has been appointed assistant superintendent of the Chicago division of this road, with office at Chicago.

Mr. E. E. Stoup has been appointed superintendent of the Southern Railway, with office at Birmingham, Ala., to succeed Mr. W. M. Deuel, transferred to other duties.

Mr. R. H. Cobbs, Jr., heretofore chief engineer of the Tombigbee Valley, has been appointed superintendent of that road, in charge of transportation, maintenance of way, and equipment, with office at Fairford, Ala.

Mr. W. A. Witt has been appointed superintendent of the Seaboard Air Line at Jacksonville, Fla., to succeed Mr. H. W. Stanley, promoted.

Mr. M. V. Hynes has been appointed division engineer of the Cincinnati, Hamilton & Dayton, with office at Indianapolis, Ind.

Mr. F. L. Thompson, heretofore roadmaster of the Illinois Central at Louisville, Ky., has been appointed assistant engineer of bridges of that road in charge of track elevation.

Mr. R. W. Gooch has been appointed roadmaster of the Chicago, Rock Island & Gulf, with office at Fort Worth, Tex., to succeed Mr. G. W. Sanborn, resigned.

Mr. Homer Eads has been appointed superintendent of the International & Great Northern at San Antonio, Tex., to succeed Mr. Thomas Hume, transferred.

Mr. G. V. Peyton has been appointed superintendent of the Southern Railway at Alexandria, Va., to succeed Mr. C. S. Lake, who has been transferred to Greensboro, S. C., to succeed Mr. W. S. Andrews, resigned.

Mr. R. W. Miller has been appointed superintendent of the Missouri & Louisiana R. R., with office at Neame, La.

Mr. Charles McK. Watts has been appointed assistant chief engineer of the Pittsburg, Binghamton & Eastern, with office at Canton, Pa.

Mr. William Bennett has been appointed acting roadmaster of the Missouri & North Arkansas, with office at Harrison, Ark., to succeed Mr. Edward Eagan, resigned.

Mr. H. H Harman, heretofore acting engineer of bridges, has been appointed engineer of bridges of the Bessemer & Lake Erie R. R., with office at Greenville, Pa.

Mr. R. B. Watson has been appointed engineer of tests

of the Erie Railroad, with office at Meadville, Pa., to succeed Mr. J. G. Platt, resigned.

Mr. E. Phenneger, superintendent of the Southern Railway, at Wilmington, N. C., has been transferred to Richmond, Va. Mr. J. C. Murchinson succeeds Mr. Phenneger as superintendent at Wilmington, N. C.

Mr. W. L. Derr has been appointed superintendent of the Chicago & Alton at Bloomington, Ill., to succeed Mr. E. Ryder, resigned. Mr. Derr was formerly superintendent of the Hartford division of the New York, New Haven & Hartford R. R.

Mr. J. F. Murphy has been appointed superintendent of the Missouri Pacific at Wynne, Ark., to succeed Mr. H. L. Hungerford, resigned.

Mr. H. G. Kruse has been appointed superintendent of the Peoria & Pekin Terminal, with office at Peoria, Ill.

Mr. Charles M. Cornwall, heretofore roadmaster of the Chicago, Indianapolis & Louisville at Bloomington, Ind., has been appointed general roadmaster of the Detroit, Toledo & Ironton, with office at Toledo, O.

Mr. L. E. Haislip has been appointed assistant division engineer of the Baltimore & Ohio R. R. at Pittsburg, Pa., to succeed Mr. E. D. Jackson, transferred to Baltimore, Md.

Mr. M. V. Haynes has been appointed division engineer of the Cincinnati, Hamilton & Dayton, with office at Indianapolis, Ind.

Mr. B. E. Mosher has been appointed roadmaster of the International & Great Northern, with office at Palestine, Tex.

Mr. D. J. Shall has been appointed assistant superintendent of maintenance of way of the San Antonio & Aransas Pass Railroad, with office at Yoakum, Tex.

Mr. F. K. Zook has been appointed engineer of maintenance of way of the Northwestern Pacific, with office at San Francisco, Cal.

Mr. W. L. Mattoon has been appointed division engineer of the Toledo & Ohio Central, with office at Columbus, O.

The title of Mr. F. W. Smith, principal assistant engineer of the Cleveland, Cincinnati, Chicago & St. Louis, has been changed to construction engineer. Mr. O. E. Selby, heretofore bridge engineer, has been appointed engineer of bridges and structures. The title of Mr. A. L. Kuehn has been changed from superintendent of maintenance to engineer of track and roadway. Headquarters, Cincinnati, O.

Mr. Louis C. Stubbins has been appointed division engineer of the St. Louis, Iron Mountain & Southern at Chester, Ill. Heretofore Mr. Stubbins has been roadmaster at Coffeyville, Kan.

Mr. Joseph Wanbecq has been appointed resident engineer of the Ann Arbor and the Detroit, Toledo & Ironton at Toledo, O.

Mr. F. W. Easton, heretofore roadmaster of the Southern Pacific at Ogden, Utah, has been appointed to the newly created office of general track inspector of the Southern Pacific lines east of Sparks, Nev., and of the Oregon Short Line, with office at Ogden, Utah.

Cafferty Tie Handling Tool

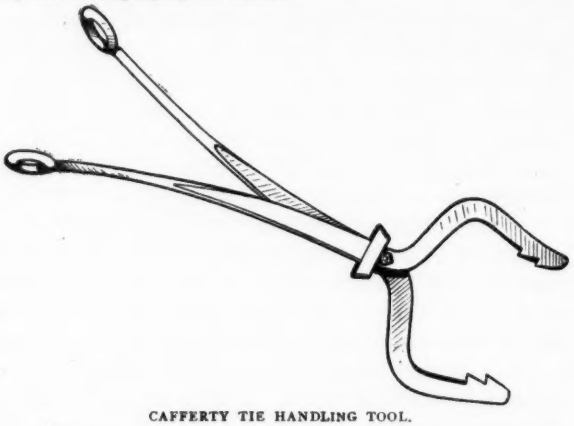
The damage by pick puncturing as the result of driving the point of a pick into the top surface of a tie in pulling it under rails is thoroughly appreciated by those familiar with this class of work. Many maintenance of way engineers and roadmasters object to the use of a pick being inserted into ties as it splits them and leaves holes to collect moisture, and such an accumulation of moisture naturally leads to decay of the timber.

In order to obviate the many objectional features incident

CAFFERTY TIE HANDLING TOOL IN USE.

to the use of the pick in moving ties, a tie handling tool has been devised which is proving very satisfactory in service, as it provides a convenient and practical method of griping a tie and leaves no undesirable effects.

The construction and operation of this device is clearly shown by the accompanying illustrations.



CAFFERTY TIE HANDLING TOOL.

This tool originated with a veteran roadmaster, who appreciated the necessity of such a device, and the following quotation from a foreman indicates very clearly its practical service. This foreman writes: "I can pull a long switch tie with this tool as easy as three men can with a pick and not ruin the tie by leaving it full of holes." Naturally, this device is equally available for putting in new ties as it is for pulling out old ones. It saves time and prevents serious damage to ties and timbers, and handles all sizes of ties with much less effort than with the pick or by the hands alone.

The tool is thirty-two inches long and weighs ten pounds. In view of its simple construction, its cost is small. It is manufactured by the Quincy, Manchester, Sargent Company, Old Colony Building, Chicago, Ill.

A Pendulum Hand Level

A very ingenuous hand level which has recently been successfully used will be seen in the accompanying illustrations. This instrument affords as fast work as the ordinary hand level with the additional advantage of more accurate results. It is constructed of a brass tube and pendulum in the form of a T, which swings on a pivot in a wooden staff. The brass tube contains the eye piece which has a small orifice and the cross hairs. The peculiar feature of this instrument is that it has no magnifying

PENDULUM HAND LEVEL IN USE.

SHOWING PENDULUM, CROSS-HAIRS AND EYE PIECE.

glass or glass of any sort. The heavy metal pendulum answers the same purpose on this instrument as the spirit level does on the hand level. The only adjustment screw to be used is the one to focus the eye piece which is incidental.

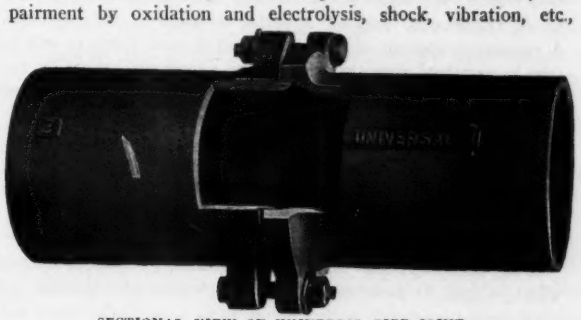
The wooden-staff is about 5 feet high and convenient for the ordinary man to make readings. This level which is light in weight is especially adapted for railroad work, running levels, cross section work, etc. It also meets the requirements of highway engineers, inspectors, contractors and masons.

The inventor, Mr. G. G. Townsend, of Frostburg, Md., has used it with success in giving elevations for bridge masonry, culverts, track cross sectioning, etc. Upon one occasion he was setting some surface stakes on a tram-road in which he started from a well established bench mark and going to the next 2,700 feet away, his readings showed a slight error of .15 feet. This record is not bad considering what errors occur in hand level work. Upon another occasion in going 4 miles he was out .3 feet. The latter test was made along the side of a high hill and during heavy wind.

It is hoped this instrument will answer the needs of many engineers who may be looking for a quick and fairly accurate level.

Universal Pipe

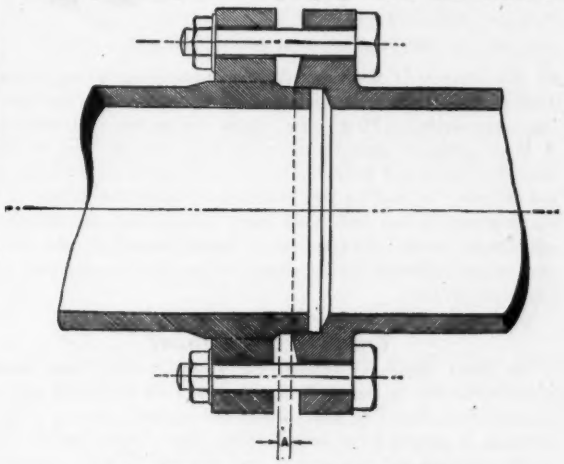
In digging trenches for mains leading to and from the water tank it may at times be impossible to get the base so that the pipe will bear at all places. In such instances it is evident that unequal settling will take place and will result in excessive strain upon the pipe joints, and eventually cause leaking joints. This and other causes, such as expansion and contraction, impairment by oxidation and electrolysis, shock, vibration, etc.,



SECTIONAL VIEW OF UNIVERSAL PIPE JOINT

are the main factors in leaky joints. Probably the greatest amount of leakage is caused by expansion and contraction, characteristic of all metals. Unequal settling generally causes rupture to refractive piping which will need immediate attention. Probably the most commonly used refractive piping is cast iron and as there are at times questions arising as to its durability underground it may be of interest to know of a long service record which has recently been made known.

In the year 1802, the first pumping station was erected for



CROSS SECTION OF UNIVERSAL PIPE JOINT.

supplying Paris with water. This station has recently been abandoned. The water mains which were flanged cast iron pipes had to be removed and upon examining the condition of this pipe, which was immersed for over a century, it was found in such condition that it could have been relaid, but being an old type was broken and melted. After removing the scale and the shellfish which had accumulated upon the exterior, the raised letters on the pipe could be easily read. This is an exceptionally good record and it shows the possibilities of cast iron when im-

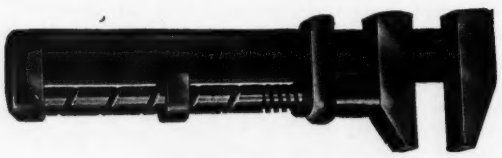
LENGTH OF UNIVERSAL PIPE.

mersed. The metal was a gray iron of excellent quality the fractures of which were as sharp as a piece just from the foundry.

Many engineers prefer to deal with occasional great leaks in water mains due to breakage rather than with innumerable small ones. In the case of a break the defect is immediately repaired, thereby making such changes in the piping as will eventually result in perfecting all irregularities. The accompanying illustrations show a representative type of refractive piping which is of cast iron. This style is the straight taper metal contact joint which requires no packing material to make it self-contained. A reasonable amount of play is allowed in each joint, as will be seen in sectional view, to take up the movement caused by expansion and contraction which rarely exceeds two inches in one thousand feet. This movement is irresistable and must be accommodated or it will accommodate itself in some form or other. This is called the Universal Cast Iron Pipe. It is marketed by Julian L. Yale & Co., Railway Exchange Bldg., Chicago, Ill.

Automatic Quick Acting Wrench

It has been the repair man's long felt want to obtain a wrench which would do away with the slow process of adjusting the opening in the wrench with a screw to fit a particular sized nut. This wish has been realized in a way by a wrench which has recently been put on the market by the Mason Wrench and Tool Co., First National Bank Building, Chicago. An illustration



AUTOMATIC QUICK ACTING WRENCH.

of this wrench is presented by the accompanying engraving. This wrench, while it does not do away with adjusting the opening in the wrench with a screw, allows a more rapid adjustment. A block which is grooved to fit the helix on the stem of the wrench is prevented from revolving by the guide on the body of the wrench. In moving this block up or down the desired size opening may be had with much more rapidity than the old style adjustment screw. This wrench is manufactured in four sizes and in two different styles which enables them to be used on any class of work.

Track Work Shovel

The most important requirement in maintaining good track surface and line is thorough drainage, without which all efforts to hold first class line and surface are wasted. Where proper drainage is provided the desired results can be more readily and easily obtained and the surface and line can be more economically maintained and preserved. Ditches deep enough simply to

TRACK SHOVEL.

drain the ballast are better than none at all, but they should be in addition to this deep enough to drain the sub-grade properly. The nature of this work requires considerable skill and as this is not to be had at all places it has been found beneficial in the past to furnish the men with good tools. Of these the shovel is probably the most important and the accompanying engraving ilustrates a shovel well adapted for this work. This is a plain back shovel. It is manufactured and marketed by the Jackson Shovel and Tool Company, Montpelier, Indiana.

Technical Publications

SYMMETRICAL MASONRY ARCHES. *By M. A. Howe.*—This treatise on arches takes up the method to be employed in the designing of masonry arches according to the elastic theory. The author devotes some space to describing the merits of different construction materials such as natural stone, plain, and re-inforced concrete, as well as, discussing and developing difficult problems. The first and second examples have been solved by a somewhat longer method than necessary, but this was done to show clearly the several processes and checks. The third example takes up a simple solution of the formulas for the horizontal thrusts and bending moments at the supports, etc.

As masonry arches are constructed under conditions of more or less uncertainty, the author avoids the developments of long formulas, preferably making a recapitulation of mathematical deductions at hand, and ending up by giving simple formulas which are of practical use. This will greatly aid the undergraduate or engineer in getting a line on this material without reviewing the theory of arches in a comprehensive manner.

In connection with this treatise the general data for over 500 arches has been compiled and tabulated for the benefit of those who desire to follow precedents and as an aid in making preliminary calculations and estimates.

Price $2.50. Published by John Wiley & Sons, New York.

RAILROAD CURVE TABLES. *By R. S. Henderson.*—This book was written for the use of field engineers and contains such data, tables, etc., as will aid them in running in railroad curves. All theoretical discussions are omitted and nothing but practical formulas are given. Some practical problems are also taken up demonstrating and developing different features of the example at hand.

Price: leather, $1.50; cloth, $1.00. Published by the Engineering News Publishing Co., New York.

ECONOMICS OF ROAD CONSTRUCTION. *By H. T. Gillette.*—This is the second edition of this work and is enlarged and illustrated. The construction of roads with deep and shallow ditches is taken up and some space is devoted to standard cross section for Macadam roads in different localities. There is a discussion on repair and maintenance of roads and improvements are suggested; also some road specifications, giving size of street, depth of pavement, final surfacing and materials are included.

Price, $1.00. Published by The Engineering News Publishing Co., New York, N. Y.

TOPOGRAPHICAL RECORD AND SKETCH BOOK FOR USE WITH TRANSIT AND STADIA. *By D. L. Turner.*—The purpose of this book is to aid instructors in civil engineering schools securing good notes from students when they are in the field. It is the outcome of several years' experience in teaching students topographical surveying. This book has both the common level note book ruling as well as concentric circles and radial lines. It is not only adapted for students but makes a very complete and handy note book for engineers in practice.

Price: leather, $1.25; cloth, $0.75. Published by the Engineering News Publishing Co., New York.

WANTED—A Civil Engineer, technical graduate, of seven years experience in railroad work, desires to make a change. At present he is resident engineer on large Northern trunk line. Anyone interested address, R. E. care RAILWAY ENGINEERING, Security Bldg., Chicago.